COMMERCIAL
WASTE COMPOSITION STUDY

VOLUME II
OF THE
ONTARIO WASTE COMPOSITION STUDY

JULY 1991

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COMMERCIAL WASTE COMPOSITION STUDY

VOLUME 11 OF THE ONTARIO WASTE COMPOSITION STUDY

Report prepared by:
GORE & STORRIE LIMITED

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INFORMATION FOR THE READER

The results of the Ontario Waste Composition Study appear in three volumes.

Volume I contains the results of the residential portion of the Ontario Waste Composition Study. The emphasis in Volume I is on the development and testing of a method that municipalities can use to estimate per capita generation rates of residential refuse. The field work for Volume I took place in East York, Fergus, and North Bay, Ontario.

Volume II contains the results of the commercial portion of the Ontario Waste Composition Study, which are presented herein. Waste generation data for two light industrial businesses are also provided in Volume II. The emphasis in Volume II is on the development and testing of a method that municipalities can use to estimate per employee waste generation rates and, further, to estimate the quantity of waste generated from all commercial sources. The commercial component of the study took place in the Regional Municipality of Waterloo.

Volume III is a "user friendly" manual that outlines the procedures for conducting residential and commercial waste composition studies in municipalities of Ontario.

ABSTRACT

Volume II, the Commercial Waste Composition Study, is the second of the three volumes comprising the Ontario Waste Composition Study.

The commercial study was conducted in the Regional Municipality of Waterloo between May 15 and August 31, 1990. The study focuses on developing a cost effective method for conducting waste composition assessments, estimating per employee waste generation rates in commercial businesses and estimating the waste generated by the entire commercial sector in a municipality.

Statistics Canada, as part of their Standard Industrial Classification (SIC), has disaggregated the universe of economic activity in Canada into 18 divisions. The same classification is used for all of Statistics Canada's economic surveys. The SIC provides the basis for the selection of commercial activities to be studied, and for the extrapolation of sample results into municipal totals.

Within this universe of activity, the commercial waste composition study focuses on six divisions whose activities take place within the private sector and serve local communities. As these commercial activities are located within the communities they serve, the number and size of these activities can be readily predicted from a knowledge of the size and characteristics of the residential population.

Statistics Canada further disaggregates these six divisions of commercial activity into 27, two-digit SIC codes, each representing a familiar group of retail or service activities. In order to get the most information from a limited number of samples, these two-digit groups were further aggregated and disaggregated. The idea here was to aggregate those groups that appeared to have similar waste generation patterns, and to disaggregate those that had varied rates of waste generation. For example, the automotive group was disaggregated to reflect fundamentally different

kinds of operations in dealerships, garages and gas stations. Among financial services, only banks were sampled.

Waste composition information (65 separate collections) and per employee waste rates (212 samples) were obtained for representative commercial businesses. Per employee waste generation rates were estimated from regression analyses or data averaging.

Estimated average employee waste generation rates for each disaggregated commercial activity were multiplied by total Regional employment in the activity to obtain estimates of waste generation for the activity. The latter estimates were summed to give a total estimate of waste generated by commercial businesses in the Region.

The study did not include schools (see Volume I), hospitals and other health care facilities, government offices or wholesale activities. However, two "light" industries were sampled.

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EXECUTIVE SUMMARY

The two-fold purpose of the Commercial Waste Composition Study was to:

1. develop a simple, cost effective and reliable method for determining the composition and per employee generation rate of waste from commercial sources in Ontario (the study concentrated on that portion of the commercial waste stream that can be closely related to residential waste; that is, both waste streams stem from the same processes of consumption); and

2. apply the method and obtain current information on the characteristics of commercial waste streams.

A review of relevant literature and consultation with experts in the fields of employment, commercial structure, demographics and waste management indicated that commercial waste generation is related to the number of employees at a particular commercial establishment.

Commercial activity in Canada is organized by the Standard Industrial Classification (SIC) established by Statistics Canada. This classification was used as the basis for reporting waste composition and per employee generation rate data. Before the field study began, the commercial business SIC codes were reviewed with respect to retail/service activities to determine whether certain sectors could be grouped together.

The Census of Canada (1986) gathered information about occupation, type of employment and place of work from a twenty percent (20%) sample of households. These data provide information about the number of employees in 36 different commercial sectors within each of the urban census areas in Ontario. This kind of information was gathered for the Regional Municipality of Waterloo, including the Cities of Kitchener, Waterloo and Cambridge, and the Townships of

Woolwich, Wilmot, Wellesley and North Dumfries. The field study was undertaken in the Region between May 15 and August 31, 1990.

A representative sample of businesses from the SIC groupings were identified and approached by the study team to gain permission to include them in the study. Data were then gathered on the composition of the waste stream from each SIC grouping, and an estimate of the average generation rate of total waste per employee was made for each of the SIC groupings. Sixty-five businesses were analyzed for both waste composition and per employee waste generation rates. Eighty additional companies were sampled only to obtain per employee waste generation rates. Some companies of the latter group were sampled twice for a total of 212 samples forming the per employee waste generation data base of this study.

The relationship between waste generation and employment was completed by regression analysis when the characteristics of the data set, (eg. sample size) permitted. In other cases an average of the waste generation data is reported where regression analysis was deemed inappropriate.

Estimated average per employee waste generation rates for each commercial activity were multiplied by the total Regional employment in the activity to obtain estimates of the waste generation for the activity throughout the entire Region.

Conclusions

1. Waste composition and per employee generation rates have been estimated for the commercial businesses in the Regional Municipality of Waterloo. The methods used in the present study provides direct estimates for 52% of the total employment in commercial business in the Region and indirect estimates for 100%. Thus, estimates of the waste generated by a segment of the commercial sector of the municipality have been made for the first time.

The total annual tonnage received by the two Region of Waterloo landfill sites in 1989 was 439,000 tonnes. Based on the results of the present study, the commercial sector contributed an estimated 76,388 tonnes, or 17.4% of the total weight.

2. The most commonly encountered waste material in commercial refuse was corrugated cardboard (OCC) which ranged from a low of 4.0% to a high of 49.0% of the weight of refuse generated by the firms which were sampled.

   The wide range in OCC content may be the result of some firms separating used OCC for recycling, possibly in anticipation of the proposed ban on the landfilling of OCC within the Regional Municipality of Waterloo in 1991.

   Variations observed in the composition of other waste streams may be due to recycling activities, either under the auspices of company-wide programs or by conscientious employees who took materials to recycling locations in the municipality or home to their own Blue Boxes.

3. The statistical reliability of the waste composition data for some of the SIC groups is questionable because of the small number of waste samples that were sorted. Nevertheless, the data indicate the general proportion of materials in the waste streams from the 16, two-digit SIC groups that comprise the commercial business community in the Region. Waste from 65 businesses was sorted.

4. The installation of a truck-mounted scale, used to determine the weight of refuse in 2 to 8 cubic yards refuse bins, enabled us to obtain waste quantity data from an additional 80 commercial businesses. For estimating the per employee waste generation rates, this method is more efficient than the labour intensive method, used in the waste composition part of the

study, in which the crew unloaded the refuse bins by hand to determine the total weight of the waste in the bin.

5. During the course of the study, insights were noted regarding the effectiveness of waste management practices of some firms. For example, for automotive repair businesses, it appears that employee's tend to use the general refuse bin for discarding metal waste materials, despite the fact that a scrap metal bin has been made available.

   Such insights, when communicated to the management of the firm provide an immediate opportunity to help that firm improve the efficiency of their recycling efforts.

   There is also an indication that differences exist in per employee waste generation rates in small grocery stores and in larger supermarkets.

   The demonstrated method for estimating the rate of employee waste generation has the potential to be used as a waste management tool by municipalities. The distribution of the daily waste generation rates versus employment data, exhibited in the graphs for each SIC sector, could enable municipal waste management personnel to prioritize their "remedial" waste reduction efforts by planning to visit those companies whose waste generation rates seem out of line with the general waste-to-employee relationship.

Recommendations

The methods employed in the commercial portion of the Ontario Waste Composition Study have been demonstrated on a selection of commercial businesses in the Regional Municipality of Waterloo. Within the commercial sectors in the Region there is a relatively high awareness of waste diversion options that will reduce waste disposal costs and encourage recycling. Therefore,

we cautiously regard the qualitative and quantitative data presented herein as a best estimate under constantly changing circumstances.

This report has developed a procedure for estimating the amount of waste generated by commercial activities within Ontario urban areas and began with the process of integrating the complex data inputs required. What are the next steps?

The study has employed a two-stage estimation process: (1) the development of ratios of waste generation per employee; and (2) the estimation of commercial employment composition for the municipality as a whole. Each step poses different problems. The following recommendations are submitted:

1. The waste generation and composition data base will require many more samples in order to cover the full range of commercial activities. No one study will have the resources to undertake a complete evaluation; the research results must be accumulated over many studies and evaluated over time. Fortunately, there is no inherent reason that a business in any part of the province cannot be used to estimate waste generated elsewhere--unless local waste management policies differ significantly.

   This means that each study should use the same SIC identification to code commercial activity and the same methodology for measuring waste output and composition. A central agency (e.g., the Ministry of Environment) may have to take the responsibility for organizing and evaluating the data.

2. It will also be necessary to monitor any changes over time in waste generation that may reflect innovations in policy, technology or corporate behaviour. The date of each sample must be retained and/or it may be necessary to identify sample locations that can be restudied over time in order to minimize sampling error.

3. To better understand the effect of recycling behaviour on the data gathered, it is recommended that employees/management of participating firms be asked to describe the nature and extent of any source separation recycling activities.

4. The immediate priorities for sampling can be identified from the results of this study. Those commercial activities that employ large numbers of people must be further investigated in order to improve sample size and reveal any significant variation within the SIC groups; this includes the diverse set of office and financial activities. Conversely, those activities with a high rate of waste generation per employee, such as food stores and restaurants, must be sampled repeatedly because of their importance to the overall waste generation. Those sectors where the observed sample variance (standard deviation) is high require larger samples to improve overall accuracy, possibly by isolating subgroups within the SIC. Activities that generate policy-relevant waste materials should be given special attention.

5. The future development of employment estimates requires two divergent approaches. First, substantial savings may result from a centralized, standardized analysis of employment that applies the same set of data, techniques and projections to all urban areas--much as the Ontario Statistical Centre has developed a common set of population forecasts.

   At the same time, municipalities have better information about local peculiarities and exceptions to the employment structure. These special cases, e.g., community colleges, tourist attractions, shopping concentrations, as well as manufacturing activities, may require special attention by a local agency.

SECTION 1

INTRODUCTION & LITERATURE REVIEW

1.0 INTRODUCTION & LITERATURE REVIEW

1.1 Introduction

In recognition of a pressing need to improve the way in which waste is managed in Ontario, the Ontario Ministry of the Environment has initiated programs and established specific goals designed to ensure the development of innovative and integrated waste management systems. For example, the Ministry has issued Terms of Reference and assisted in the funding of Waste Management Master Planning for municipalities. Specific objectives for diverting significant amounts of waste from disposal through reduction, reuse and recycling activities (25% by 1992 and 50% by 2000) have also been announced by the Government of Ontario.

In order to effectively plan and design waste management systems that will achieve those goals, reasonably accurate estimates of the types and quantities of waste must be available. For example, the design of material recovery facilities that will receive and process waste must be compatible with the range of wastes anticipated to be received by the facility.

The Ministry of the Environment contracted Gore & Storrie Limited, in association with Decima Research Limited, to develop and test methodologies that would assist waste management planners and municipalities in deriving reasonable estimates of the material composition and generation rate of wastes from residential and commercial sources. The results of that study are presented in three volumes:

Volume I - Residential
Volume II - Commercial
Volume III - Procedures Manual

The results of the commercial portion of the Ontario Waste Composition Study are presented herein, and describe the development and field trial of a methodology for estimating the type and quantity of waste generated by a variety of different types

of commercial enterprises; i.e., those firms in the private sector that provide goods and services for consumers. Although these activities may be concentrated at a small number of locations within the urban area, such as "downtown", or a regional mall, the aggregate amount of commercial activity is very closely related to both the number of households and household income in the urban area. Commercial waste, in this sense, can be closely related to residential waste. Both waste streams stem from the same processes of consumption.

The Study focused on the commercial activities that are most closely linked to residential requirements. The waste generation from office buildings is an important component; but it is difficult to distinguish offices that serve local residents (e.g., a lawyer) from those that serve the province as a whole (e.g., an insurance firm). Wholesale activities, while part of the commercial waste system, also serve larger spacial units. They are too varied in their size and function to fit into the present sampling framework. They must be studied elsewhere, when a community studies the entire waste stream in their area. A review of relevant literature and consultation with experts in the fields of employment, commercial structure, demographics and waste management indicated that commercial waste generation is related to the number of employees at a particular commercial establishment.

The plan for the Study was developed during the winter of 1989/1990. The study uses the extensive information on the amount and composition of commercial employment provided by Statistics Canada and local government agencies to define a sampling framework for the field work.

Commercial activity in Canada is organized by the Standard Industrial Classification (SIC) established by Statistics Canada. This classification was used as the basis for reporting waste composition and per employee generation rate data. Before the field study began, the commercial business SIC codes were reviewed with respect to retail service activities to determine whether certain sectors could be grouped together.

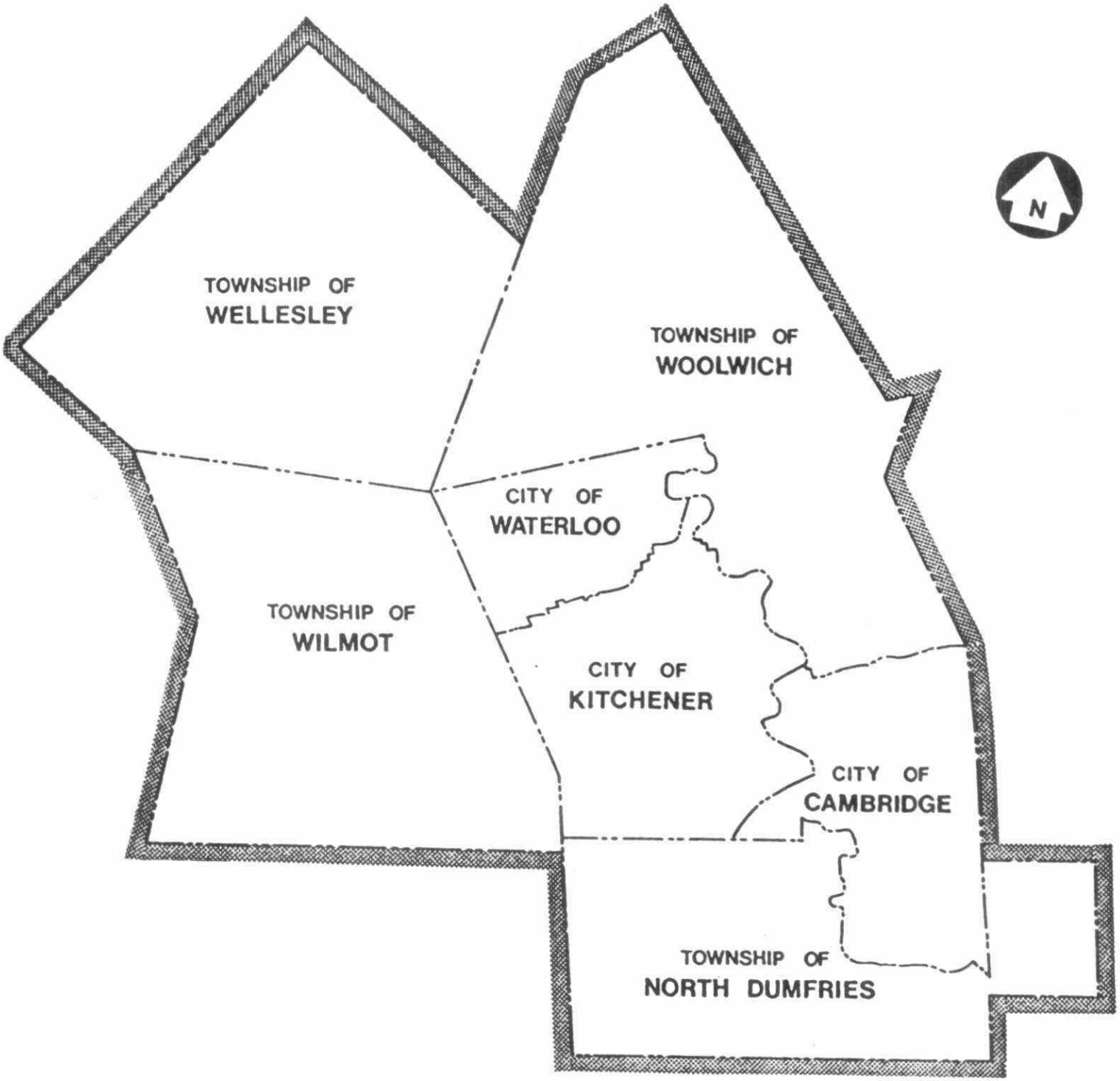
The Census of Canada (1986) gathered information about occupation, type of employment and place of work from a twenty percent (20%) sample of households. These data provide information about the number of employees in 36 different commercial sectors within each of the urban census areas in Ontario.

Figure 1 is a map of the field study area which is the Regional Municipality of Waterloo, including the Cities of Kitchener, Waterloo and Cambridge, and the Townships of Woolwich, Wilmot, Wellesley and North Dumfries. The field study was undertaken in the Region between May 15 and August 31, 1990.

A representative sample of businesses from the SIC groupings were identified and approached by the study team to gain permission to include them in the study. Data were then gathered on the composition of the waste stream from each SIC grouping, and an estimate of the average generation rate of total waste per employee was made for each of the SIC groupings. Sixty-five businesses were analyzed for both waste composition and per employee waste generation rates. Eighty additional companies were sampled only to obtain per employee waste generation rates. Some companies of the latter group were sampled twice for a total of 212 samples forming the per employee waste generation data base of this study.

This report establishes a methodology for measuring waste generation and waste composition for commercial activities, as defined above. For a number of reasons, the study of waste generation by these activities is a much more complex problem than that of residential activities reported in Volume I of the Ontario Waste Composition Study. First, very little published research is available for commercial activities (none for Canada in recent years) and therefore the research team had little a priori knowledge of expected values or variance to guide the design of an efficient sampling framework. Second, as apparent in the discussion of the results, commercial activities are characterized by very high variance, relative to the residential sector. That variance is observed in waste generation both within and among the various retail and service sectors. There was also a wide range in

FIGURE 1 MAP OF THE REGIONAL MUNICIPALITY OF WATERLOO



REGIONAL MUNICIPALITY OF WATERLOO
DEPARTMENT of PLANNING and DEVELOPMENT

0 5 10
SCALE
(kilometers)

store size (measured in level of sales or employment) within these sectors that must be taken into account. These variations mean that a much larger number of samples are required in order to provide the same degree of reliability obtained in the study on residential waste generation. Third, while detailed descriptions of household characteristics are provided by the Census of Canada, together with a variety of forecasts of growth and change provided by market research firms and government agencies, it is difficult to identify even the base population for a sample of commercial activities. It is not common for a single data source to provide counts or lists of the number of supermarkets or barber shops within a municipality. Sample locations must be identified in the field; extrapolations to obtain municipal or regional totals now and in the future require elaborate assumptions and indirect procedures.

Nonetheless, the report describes a workable method, and provides sufficient data to support an overall estimate of waste generation for the Region, together with the major components of the waste stream. While many more sample points will be required to increase the precision of estimates of waste streams for specific commercial activities, studies at the municipal level benefit from the effect of aggregation in which hundreds or thousands of activities are averaged together. The report also provides a methodology for future studies that overcomes each of the difficulties identified earlier. Data on commercial waste generation and composition are now available to guide the design of waste sampling procedures. The identification of high waste generation activities in this study permits agencies to target waste reduction and recycling programs on these activities. The difficulties, due to varying store size and unavailable data on the population of stores, have been overcome by focusing on number of employees as the key measure that connects the sample observation to the overall data analysis and ultimately to the aggregate waste generation by the municipality. The number of employees in each SIC code is listed by Statistics Canada in their data base.

It would have been possible to restrict the study to just a few well chosen SIC groups in order to achieve greater confidence in the waste estimates. However, we

chose a broader study in order to assess the variances encountered in various SIC groups. This choice benefits subsequent workers who can target their efforts to develop and enhance a data base of waste generation for commercial activities in Ontario.

1.2 Literature Review

The Bird & Hale report (ref. 2) has been used as the baseline study for waste composition information on the municipal solid waste stream in Ontario. In the Bird & Hale study, the average annual composition of municipal solid waste entering landfill sites, transfer stations and incinerators, in Toronto, was derived from samples obtained during spring, summer, winter and fall. Twelve visits were made to six sites between October, 1976 and September, 1977, with two visits apiece at: Commissioners Street Incinerator, Ingram Incinerator, Dufferin Incinerator, Beare Road Landfill Site, Bermondsey Transfer Station and Wellington Incinerator. Sample weights of municipal solid waste ranged up to 400 lbs. (180.7 kg).

Municipal solid waste has been traditionally defined as a combination of waste from residential and commercial sources, so the Bird & Hale study--which collected and reported on this combined municipal solid waste data--does not serve as a suitable baseline for the present work which focuses on the commercial activities that are related to residential consumption.

The earliest studies of the composition of commercial solid waste were reported by Peter Middleton & Associates (ref. 11). They briefly described three studies: Louisville (1970), Proctor & Redfern (1972) and Proctor & Redfern (1975), each based on questionnaires sent out to commercial businesses. The Louisville study reportedly divided the commercial sector into 18 different categories but regrettably this detail was not provided in the main report or appendix. The same is true of the two Proctor & Redfern reports. The questionnaires reportedly contained information on the categories of commercial businesses, but the information was reportedly lost (ref. 11).

Franke (ref. 5) described the general composition of the commercial waste stream in Cologne, Germany (1980/81 data) and Evans (ref. 4) reported the weight and volume of components in the waste streams from "retail", restaurants and office towers in Toronto (1984 data). More recently, Rhyner & Green (ref. 14) compared published literature data on per capita or per employee waste generation rates for residential, commercial, industrial and construction demolition wastes with actual waste data that they were obtaining at county-owned landfill sites in Brown County, Wisconsin. Annual solid waste generation estimates were calculated for a number of SIC codes in the commercial sector. Rhyner & Green's estimates of the annual generation of commercial refuse, using a daily employee generation rate of 0.73-0.77 kg and county employment data, was within 15% of the "actual quantity". Table 1 summarizes the available information on the composition of commercial waste streams, from sources reported above.

A key paper that became the basis for the data gathering procedures developed in the present study was published in 1971 by DeGeare & Ongerth (ref. 3). The authors explored the relationship between waste generation in clothing, drug, grocery, hardware stores, and restaurants as a function of a number of variables indicative of the physical and operational characteristics of commercial establishments. For example: (1) number of hours open per week; (2) number of business days open per week; (3) average annual gross receipts; (4) physical area of store, in square feet; (5) average inventory in dollars; (6) equipment value, in dollars; (7) number of delivery days per week; and (8) number of employees. Number of employees and store hours were the two variables that gave the best prediction of the waste generation rate for premises in the commercial sectors under study.

DeGeare and Ongerth, using "multiple stepwise regression analyses", demonstrated that the generation of commercial solid waste was found to be most closely related to the number of employees, hours open, and type of establishment involved. Graphs illustrating the correlation between actual and predicted waste quantities from the DeGeare and Ongerth study are reproduced in Appendix A.

TABLE 1 COMPARISON OF WASTE COMPOSITION INFORMATION FOR THE COMMERCIAL SECTOR - PUBLISHED DATA[1] (PERCENT OF TOTAL)

Material	Proctor & Redfern (1972; 1975)	Evans (1985)			Louisville (1970)	Liblit (1990)					Franke (1987)
		Retail	Restaurant	Office Towers		Retail Trade	Restaurant	Office	School	Government	
Newsprint		6.2	2.7	6.3		2.9	2.5	3.6	3.3	6.7	
Brown Paper		2.8	2.9	8.6							27
OCC	51 - 65	16.5	4.0	2.9		22.0	16.6	11.5	11.6	8.4	total
Fine Paper	total paper	15.4	15.4	66.9		1.4		10.6	6.3	7.2	paper
Other Paper		24.3	22.5	10.6		15.2	18.5	38.5	26.6	31.5	
Food Waste		9.6	42.9	1.1		8.1	36.0	3.0	14.0	3.2	10 organics
Vegetation		0.0	0.0	0.0							
Plastic	1 - 2	19.1	4.8	1.1	9.4	12.0	13.7	4.3	5.1	3.5	9
Textile/Cloth		2.0	0.0	0.1							
Wood		0.9	0.0	0.1		10.7	0.6	7.8	21.0	20.0	11
Other Combustibles		1.1	0.6	0.8							
Ferrous Metals		1.05	1.7	0.4		19.7	4.2	2.4	3.9	9.0	
Non-ferrous metals		0.1	0.3	0.1		0.8	0.7	0.5	1.9	0.8	3 metals &
Glass	1 - 4	0.75	1.8	0.7	11.3	2.5	5.9	3.9	3.2	2.7	glass
Other non-combustibles		0.3	0.6	0.3							
Inert Materials											12
Production Wastes (Rubber, rags etc)											12
Other ("household -like" wastes)											15
Miscellaneous	1.1 - 17[2]					4.7	2.3	13.9	3.1	7.0	

[1] Data are given as percentages of the commercial waste stream. Canadian studies: Proctor & Redfern (1972; 1975), Evans (1985); U.S.A. studies: Louisville (1970), Liblit (1990); Germany: Franke (1987).

[2] Includes 12% construction wastes

Two points will clarify the relationship between waste generation and company employment. First, employment is a function of the intensity of retail activity; i.e., a small store with few customers will require a smaller sales staff than a larger store that serves a large clientele. Second, the items sold by stores are delivered in bulk, in packages, cartons, and other containers, with the individual items placed on shelves or otherwise displayed. Taken together, we see that as the size of a store's staff increases to serve increasing numbers of customers (and sales), the quantity of goods delivered to the store will grow in response to customer demand and the amount of bulk packaging and related administrative wastes will also increase.

The focus on waste generation per employee that is evident in the literature fits well with another reference that examines consumer behaviour and commercial structure (Jones & Simmons, ref. 8). This reference demonstrates that the amount of commercial activity is highly predictable from information about the size and income level of the market. Given the number of households and average income level in any city, it is possible to project first, the patterns of consumer expenditure, from toothpaste to bank deposits, in great detail; and second, to calculate the level and composition of commercial activity. Furthermore, the different measures of commercial activity (i.e., number of stores, floor area, retail sales, number of employees) are all closely interrelated. Employment happens to be the most frequently measured and readily obtained. It provides the key link between the samples from the field work and the larger municipal waste system. When one determines the waste generation per employee for a SIC group, this generation rate can be extrapolated, via Statistics Canada data on total employment in the SIC sector to get the waste generation rate for the entire company. It is then possible to determine whether a reasonable amount of waste is being disposed at a given company as compared to an average waste generation rate for a company of similar size in the same SIC sector.

The authors would like to point out that they discovered a paucity of information pertaining to this subject and have made every attempt to locate and examine all relative material.

SECTION 2

METHODOLOGY

2.0 METHODOLOGY

2.1 Overview

The general approach used in the study included the following steps:

A. Selection of Commercial Businesses

The commercial business SIC codes were reviewed with respect to retail service activities to determine whether certain activities could be grouped together. Although the commodities or services provided by businesses may differ, similarities in the waste streams permitted aggregation of sectors, and reduced the requirement for field work.

B. Development and Implementation of the Waste Sampling Program

(1) Information on the composition of the waste stream from each SIC group was obtained.

(2) An average generation rate of total waste per employee for each of the commercial groups was estimated. Waste was collected from a number of premises in each SIC group, attempting to cover a range of small and large companies. The relationship between waste generation and employment was assessed by regression analyses when sample size permitted.

C. Development of a Region Employment Profile for Commercial Activities

Statistics Canada employment data and the Region of Waterloo's planning information were analyzed to generate an estimate of the total number of people employed in the commercial groupings for which waste generation estimates were obtained.

TABLE 2: LIST OF SIC DIVISIONS

Division A	Agricultural and Related Service Industries
Division B	Fishing and Trapping Industries
Division C	Logging and Forestry Industries
Division D	Mining (Including Milling), Quarrying and Oil Well Industries
Division E	Manufacturing Industries *
Division F	Construction Industries
Division G	Transportation and Storage Industries
Division H	Communication and Other Utility Industries *
Division I	Wholesale Trade Industries *
Division J	Retail Trade Industries **
Division K	Finance and Insurance Industries **
Division L	Real Estate Operator and Insurance Industries **
Division M	Business Service Industries **
Division N	Government Service Industries
Division O	Educational Service Industries
Division P	Health and Social Service Industries
Division Q	Accommodation, Food and Beverage Service ** Industries
Division R	Other Service Industries **

* Low emphasis in study

** High emphasis in study

D. Estimation of Waste by Commercial Activities in the Region

Regional employment was multiplied by the employee waste generation rate for each SIC group to estimate the quantity of waste generated by each of the commercial activities. The sum of the waste estimates for the groups gave an estimate of waste generation by a large segment of the commercial sector in the municipality.

2.2 Commercial Employment in the Regional Municipality of Waterloo

2.2.1 Defining Commercial Activity

Statistics Canada, as part of its Standard Industrial Classification (SIC), has disaggregated the universe of economic activity in Canada into 18 groups (ref. 15). Thus, the classification provides the basis for the selection of commercial activities to be studied, and for the extrapolation of the sample results into municipal totals. The same classification is used for all of Statistics Canada's economic surveys. It enables us to apply data from the Census of Canada, or the monthly Labour Force Survey, to the task of estimating waste generation for aggregations of commercial activities.

Within this universe of activity, the commercial study focused on six divisions: J, K, L, M, Q, and R (Table 2). The activities in these divisions take place within the private sector and serve local residential communities. Thus they are located within the communities they serve, and the number and size of these activities are quite predictable from a knowledge of the size and characteristics of the residential population. Within these six divisions, Statistics Canada identifies hundreds of smaller groups of specialized activities each of which includes a large number of stores that provide similar goods and services and operate in the same fashion. Given a base population of activities, these stores can be sampled and extrapolated to provide overall estimates of waste generation.

TABLE 3: LIST OF THE 13 SIC CODE MAJOR STUDY GROUPS

Major Group	Description
17	- Leather and Allied Products Industries.
28	- Printing, Publishing and Allied Industries.
48	- Communications Industry.
56[1]	- Metals, Hardware Plumbing, Heating and Building Materials Industry, Wholesale
60	- Food, Beverage and Drug Industries, Retail.
61	- Shoe, Apparel, Fabric and Yarn Industries, Retail.
62	- Household Furniture, Appliances and Furnishings Industries, Retail.
63	- Automotive Vehicles, Parts and Accessories Industries, Sales and Service.
65	- Other Retail Store Industries (i.e. Florist Shops, Jewellery Stores etc.).
70	- Deposit Accepting Intermediary Industries (i.e. Banks, Trust Companies).
91	- Accommodation Service Industries.
92	- Food and Beverage Service Industries.
96	- Amusement and Recreational Service Industries.

[1]Retail hardware and building supplies are designated as wholesale activities in the SIC classification

In contrast, the primary manufacturing and wholesaling divisions are fewer in number and far more diverse in size and specialization. This is because they are not directly tied to or restricted by the size and requirements of local markets; i.e., those in close spatial proximity to the manufacturing or wholesaling activity. A factory may produce goods for markets across the continent using processes and materials that are quite different from a neighbouring plant--even if the plant has the same industrial classification. Some municipalities have many factories; others have virtually none. Waste generation by such activities must be studied on a site-by-site basis.

While many educational, health, and local governmental services serve local residents, some activities, such as universities or major hospitals, have been excluded from this study. As well, the lawn and yard maintenance service sector was not sampled in the present study.

The six divisions in this study include 32.8 percent of the total employment in the Regional Municipality of Waterloo. Divisions J and Q, which were sampled most thoroughly, include 18.1 percent of the total. Commercial activities are numerous and represent a significant component of the economic base of every community.

Statistics Canada further disaggregates these six divisions of commercial activity (which are included in the study) into 27, two-digit SIC codes, each representing a familiar group of retail or service activities. In order to get the most information from a limited number of samples, these two-digit groups were further aggregated and disaggregated as shown in Table 3. The general principles applied here were to aggregate those groups that appeared to have similar waste generation patterns, and to disaggregate those that had varied rates of waste generation. For example, the automotive group (SIC 63) was disaggregated to reflect fundamentally different kinds of operations in dealerships, garages and gas stations. Group 64 was estimated from the results for groups 61 and 62. Among financial services, only banks were sampled. Hotels and restaurants were each disaggregated to see if

different waste generation patterns could be identified. The final results will identify further sub-groups which are discussed later.

In addition, a limited number of samples explored economic activities lying outside the targeted divisions. Building supply stores (SIC 56) were sampled within the framework, but are formally classified as wholesale activities within the SIC. They are excluded from the expansion of the sample for the municipal total. The printing and publishing manufacturing group (SIC 28) was also sampled.

2.2.2 Extrapolation of Sample Data to a Municipality

The problem of extrapolating the results from the waste generation samples to project the waste generation for an entire area or regional municipality is complicated by the lack of information that describes the overall magnitude of commercial activity. There is no Census of Retail and Service Activity, or its equivalent. Instead, data on commercial employment obtained from several different sources must be adapted to the problem. It should be underlined that the procedures used for this extrapolation may vary from place to place, depending on the mix of information that is available.

The starting point is the Census of Canada, 1986 (soon to be superseded by the 1991 version) for the residential population. For a twenty percent sample of households, each person over 15 is asked about employment; e.g., what kind of firm? These data are coded to the SIC categories. For each Census Metropolitan Area (CMA) we know how many people work in which kinds of activities is known. Unfortunately people do not always work in the same municipality where they live. If the municipality is isolated from other places (e.g., Timmins) the assumption can be made that the residents work in the same municipality that they reside; if it is embedded within a larger economic region (e.g., the City of Toronto or the City of Waterloo) further adjustments must be made. One could shift the scale of analysis from the smaller area municipality to the region as a whole (e.g., the Greater Toronto Area, the Region of Waterloo) or one could turn to other sources of data

on employment. The Ministry of Transportation has compiled journey-to-work data for the major urban regions in Ontario that indicates how many people work in one community (e.g., the City of Cambridge) and live in another (e.g., the City of Waterloo), but these data are not broken down by SIC. Or there may be regional employment surveys that indicate how many jobs of various kinds are found in each component municipality--although they do not always use the same breakdown of commercial activities as Statistics Canada's SIC. The problem, then, is complex; and may require local expertise.

In the present study in the Region of Waterloo, the starting point was the Census of Canada material, augmented by the Region of Waterloo employment survey to provide more spatial data, and Statistics Canada's Labour Force survey, to provide a temporal update. The amount of spatial or temporal detail required will depend on the application of the information.

While there was no alternative to the use of employment data to link the waste generation sample to the projections for the municipalities, the relationship between employment and the volume of commercial activity is very strong (ref. 8). Sales, floor area, and employment are consistently linked together very closely. In the present work, employment is simply the total number of workers, both part-time and full-time--as defined by Statistics Canada. The ratio of part-time to full-time employees is consistent across each SIC sector, and the number of each type of employees should vary through time with the level of sales. Both employment and sales vary slightly from season to season (depending on the type of commercial activity). Early summer data (as used herein) provide a reasonable proxy for the annual levels as indicated by indices of seasonality computed by Statistics Canada (see ref. 16). These indices allow us to calibrate the seasonal effects at other times of the year.

2.2.3 Statistics Canada Employment Data

The Census of Canada, 1986 gathers information about occupation, type of firm and place of work from a twenty percent sample of households. A special tabulation of these data provided information about the number of employees in 36 different commercial sectors for each CMA in Ontario. The basic tabulation is by place of residence, which is not a problem for a regional municipality as a whole, but other "journey-to-work" tabulations indicate how this employment is allocated by municipality within the Region. These data can be updated by reference to the monthly survey of "The Labour Force" which estimates employment for each CMA, including Kitchener-Waterloo.

2.2.4 Regional Municipality of Waterloo Planning Information

The Regional Municipality of Waterloo, encompassing the cities of Kitchener, Waterloo and Cambridge, and four smaller Townships of Woolwich, Wilmot, Wellesley and North Dumphries, is located about 110 kilometres west of Toronto and about 60 kilometres northwest of Hamilton. The population of the Region (1988 Municipal Directory information) was 342,030. Information from an employment survey conducted by the Region's Planning Department provided additional information about the number of firms and employment in commercial activity in each of the local municipalities within the Region in 1989. The sectoral categories differ slightly from those used by Statistics Canada so the data could not be used directly in the estimate of waste generation. Instead, the information was used to estimate the share of Regional waste that is generated by each municipality.

2.3 Field Work: Methods

2.3.1 Personnel

The field crew consisted of three people; two were university graduates in environmental science and one was a college student in mechanical engineering technology. A basic background in science or engineering was deemed desirable because of the quantitative aspect of the work. The commercial portion of the Ontario Waste Composition Study was an exercise in quantitative analysis of commercial wastes conducted under field conditions, using skills learned in technical courses that are part of science and engineering education.

The crew received instruction on recognizing the categories of plastic and paper from R. Buggeln (Superintendent of Industrial/Commercial Waste Reduction), Region of Waterloo. Because the focus of the waste composition study was on method development, the crew was instructed to be critical of their procedures. The crew was encouraged to set aside all materials that were difficult to categorize, describe them in writing and include them in a 'miscellaneous' category (see Section 2.3.7 below).

2.3.2 Contacting Businesses

The field crew had considerable familiarity with a variety of businesses in the Region of Waterloo and they were able to recommend many companies to contact for the study; the Yellow Pages in the phone directory were also consulted for the names of firms. The decision on how best to approach businesses was left up to the field crew, after considering two alternatives: (a) contact by telephone and (b) direct company visits.

The field crew quickly realized that the most practical and efficient method of obtaining permission from local businesses to participate in the study was from a personal visit from the crew members themselves. The approach of contacting the

firms by telephone was very time consuming and was inherently very unsuccessful. In the direct approach, store owners or managers could see first hand, who they would be dealing with. The waste study could be discussed in detail and questions could be answered and the logistical problems at each location could be assessed. A business card from the Region's Recycling Office legitimized the crew's intentions and a rapport between the field crew team and the business could be established. In fact, more than 90% of the businesses directly approached agreed to participate in the study.

2.3.3 Scheduling Waste Collection

One objective of the study was to obtain a "snap shot" of the composition of waste generated in a week by commercial businesses. Therefore, waste collections for the study were tailored to the waste collection for each business. In the simplest case (i.e., once a week collection), the crew visited the company 12 to 18 hours before the bulk-lift refuse bin was scheduled for dumping and removed the accumulated waste. Whenever Monday was the collection day, the crew had to make their collection on Sunday.

Many businesses had to be visited 3 or more times in order to obtain a week's worth of waste. In some cases, businesses stored their waste, especially if the putrescible content was low, in order to save the crew repeated trips.

2.3.4 Special Documentation

A letter from the Ministry of the Environment authorized the collection of the waste from commercial businesses for purposes of the composition study. The private waste hauler participating in the study requested and received a letter from the Region confirming the confidentiality of the waste information obtained in the study.

The procedure to obtain Ministry approval for solid waste sample collection by municipalities undertaking waste composition studies is as follows:

A letter requesting Ministry approval for temporary collection of solid waste samples shall be mailed by the interested municipality to:

Mr. Dave Crump
Operations Coordinator
Operations Division
Ministry of the Environment
14th Floor, 135 St. Clair Ave., West
Toronto, Ontario
M4V 1P5

The letter shall include, but not be limited to the following type of information:

- Background and reasons for undertaking the study.
- Study objectives.
- Study approach.
- Contractor's name.
- Collection area.
- Approximative number of samples to be collected.
- Approximative weight of each sample.
- Estimated duration of the project.

2.3.5 Equipment Used in the Waste Study

The following list of equipment includes a rented vehicle and purchased equipment:

one - 4.3 m. (14 ft.) cube van (for collection of bagged refuse);

one - electronic platform scale (150 kg capacity, Accu Weigh Model PAK-150 (electronic, battery operated scale with digital read-out), Exact Weight Scale Inc., Toronto, Ontario);

one -electronic bench scale (500 g capacity, Accurat, model 3670)

one - chicken wire "crib": 1.2 m. (4 ft.) x 1.2 m. (4 ft.) x 1.3 cm. (1/2 in.) plywood base; 0.6 m. (2 ft.) high chicken wire and 2.5 cm. (1 in.) x 5.1 cm.(2 in.) furring sides. Nailed to the underside of the crib floor was a square frame which permitted the crib to be centred on the bed of the platform scale; the crib was used for weighing the refuse as it was being collected from the firms;

40 - 30 litre polyethylene garbage cans; these were used as containers into which sorted refuse was placed;

one - broad-mouth aluminum shovel; used for cleaning up spills;

one - broom; used for cleaning up spills and sweeping out the vehicle;

one - staple gun and 0.95 cm. (3/8 in.) staples for construction and repair of chicken wire dividers and crib;

one - claw hammer; 5.1 cm. (2 in.) common nails: used in the construction of the crib.

Personal Safety Equipment:

a) Certified steel toe safety boots
b) Coveralls
c) Orange safety vests
d) Hard hats (at the landfill)
f) Rubber safety gloves
g) Particle filter masks (dust in garbage bins)
h) Complete first aid kit (in truck)
i) Tetanus/polio vaccination
(optional: diphtheria, Hepatitis A and B).

2.3.6 Waste Collection Methods

In the Regional Municipality of Waterloo, private waste haulers are usually contracted to remove the waste from commercial businesses, except in the downtown core of Kitchener and Waterloo where waste collection was three times per week or daily, respectively. The commercial haulers provided bulk-lift refuse containers of various sizes (2 to 8 cubic yards) in which a firm's waste was accumulated and picked up

as required. In most cases, wastes were placed, loose, into the bulk bins; several businesses used compactor type bulk refuse containers.

Waste sampling procedures varied depending on whether the waste was loose or compacted. In the former case, the entire contents of the container were unloaded, weighed in a chicken wire/wood "crib" mounted on a scale (see Figures 2 and 3) and placed in 4' x 4' x 4' heavy duty corrugated containers ("gaylords") in the back of a cube van and taken to the Waterloo landfill site (parking lot of the Recycling Office) for sorting (see Figure 4).

Unloading waste from a compacted entanglement of loose and bagged refuse in a 6 or 8 cubic yard bin was very difficult. It was decided that only half of the contents of the bin could be conveniently and efficiently unloaded and weighed, given the arduous task and the time requirement. The weight of the entire bin was estimated on a volume basis from the weight of the sample that was removed, i.e., usually several hundred kilograms. All loose waste was set aside for sorting; bags of refuse were randomly placed into two piles, with an equal number of bags in each pile. One pile was randomly selected for sorting, the other pile was returned to the bin. (See Section 2.3.4)

2.3.7 Sample Sorting and Data Management

The commercial waste composition data sheets (Table 4) were used for logging the weights of the various waste materials encountered in the samples. After sorting the waste into categories, each category was weighed and its relative contribution to the total sample weight was determined, i.e., percent of the waste composition. Waste materials that could not be easily categorized, were separately identified (described and weighed) on a "miscellaneous" table, accompanying the main waste composition table for each sample. The total weight of materials in the "main" and "miscellaneous" lists equalled 100% of the sample weight.

TABLE 4: WASTE COMPOSITION DATA FIELD SHEET

Town:
SIC:
Sample # :
Collection Dates:

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

(1) Paper	(a) Newsprint				
	(b) Fine Paper / CPO / Ledger				
	(c) Magazines / Flyers				
	(d) Waxed / Plastic / Mixed				
	(e) Boxboard				
	(f) Kraft				
	(g) Wallpaper				
	(h) OCC				
	(i) Tissues				
(2) Glass	(a) Beer (i) refillable				
	(ii) non-refillable				
	(b) Liquor & Wine Containers				
	(c) Food Containers				
	(d) Soft Drink (i) refillable				
	(ii) non-refillable				
	(e) Other Containers				
	(f) Plate				
	(g) Other				
(3) Ferrous	(a) Soft Drink Containers				
	(b) Food Containers				
	(c) Beer Cans (i) returnable				
	(ii) non-returnable				
	(d) Aerosol Cans				
	(e) Other				
(4) Non-Ferrous	(a) Beer Cans (i) returnable				
	(ii) non-returnable				
	(iii) American				
	(b) Soft Drink Containers				
	(c) Other Packaging				
	(d) Aluminum				
	(e) Other				
(5) Plastics	(a) Polyolefins				
	(b) PVC				
	(c) Polystyrene				
	(d) ABS				
	(e) PET				
	(f) Mixed Blend Plastic				
	(g) Coated Plastic				
	(i) Nylon				
	(j) Vinyl				
(6) Organic	(a) Food Waste / Rodent Bedding				
	(b) Yard Waste		*******		*******
(7) Wood					
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos					
(9) Diapers					
(10) Textiles/Leather/Rubber					
(11) Household Hazardous Wastes	(a) Paints / Solvents				
	(b) Waste Oils				
	(c) Pesticides/Herbicides				
(12) Dry Cell Batteries					
(13) Kitty Litter					
(14) Miscellaneous		*******	*******	*******	*******
		TOTAL kg		TOTAL kg	

FIGURE 2: WEIGHTING COMMERCIAL WASTE IN A CRIB MOUNTED ON AN ELECTRONIC DIGITAL SCALE

FIGURE 3: REMOVING WASTE FROM A COMMERCIAL WASTE BIN

FIGURE 4: SORTING A WASTE SAMPLE AT THE LANDFILL SITE

2.3.8 Data Obtained for Per Employee Waste Generation Rates

Two sampling methods were used to determine the quantity of waste generated at each firm. In the first method, the field crew weighed the waste in the refuse containers before putting the waste in the cube van for removal to the Waterloo landfill site for sorting. As noted above, the frequency of waste collection at each firm was obtained from the owner or manager. The field crew obtained the employment figure for each business at the time of the interview or by telephone.

When it was not possible to obtain the number of full- and part-time personnel from each firm, we used the figures for total employment were used in the regressions of employment versus waste quantity. This is compatible with the data gathered by Statistics Canada.

The first method enabled us to get waste quantity information from small and medium size businesses. The method was very labour intensive and time consuming but worked well for small loads of loose waste. The method was not satisfactory for refuse compacted in 6 to 8 cubic yards containers. The latter containers were frequently encountered at some of the larger locations.

The second procedure was applicable to all bulk containers irrespective of bin size or degree of waste compaction. A scale initially developed to weigh loads of sand and gravel carried in the scoop of a front end loader has been adapted for use on overhead (front-end) loading garbage trucks. The scale works off of the hydraulic lift system that raises and lowers the arms of the bin hoist. A Wray-Tech Model WT4000/6000 (obtained from Woolsey Equipment Sales Ltd., Ottawa) was installed on an overhead packer truck and calibrated with the assistance of the Toledo Scale Company, Hamilton, Ontario.

The bulk waste weighing procedure was a two-step process. First, the bin and waste contents were weighed. Then the contents of the bin were dumped into the truck and the empty bin was weighed. The weight of the bin contents was

determined by subtracting the weight of the empty bin from the weight of the bin plus contents. Again, employment data were obtained for these firms, either by telephone or directly visiting these firms after the waste had been collected.

As noted above, participants in the study were assured of confidentiality of the waste generation and composition information. (NOTE: no locations will be identified by name in this report).

Bin collection frequency was determined from the hauler's records and a daily generation rate (kg/day) of waste was determined for each firm. At the conclusion of the field work, the employment and waste generation data were plotted on separate graphs for each of the commercial groupings. The length of the "work week" was different for different SIC groupings. Some businesses are open 7 days a week (restaurants, hotels, etc.) and some for 6 days (supermarkets, banks, automobile dealerships, etc.). Some printing shops were the only commercial businesses included in our study that operated on a 5-day work week.

2.4 Estimates of Average Per Employee Waste Generation Rates

Each sample observation provided information on the number of employees and the total weekly waste generation for the establishment. This permits two different kinds of statistical generalization. First, it is possible simply to divide the total waste by the number of employees to obtain an estimate of waste generation per employee. Several of these estimates can then be used to determine average values and standard deviations.

Second, more information can be extracted by plotting total waste against employment for each observation. This provides: (1) a visual pattern of the overall variability in the results, an evaluation of the relation between waste generation per employee and size of store (e.g., are big stores more or less efficient with respect to waste generation?); (2) a measure of the waste reduction efficiency of individual

stores relative to the group; and (3) an evaluation of the effectiveness of the sample selection in relation to store size.

By fitting a regression line to the graph we obtain another measure of the regularity of waste generation, i.e., the regression coefficient r^2. Another estimate of the relation between waste generation and number of employees is the slope of the regression line (b).

In the next step in the analysis, estimates of waste generation per employee are used to estimate total waste generation within the study area. Either the mean value of waste per employee or the regression slope (b) could be selected. The regression slope was used as long as it was adjudged reliable; otherwise the mean value was used. The reliability depends on both the regression coefficient (over 0.5) and the scatter of observations on the graph. A sample with a wide variety of different stores sizes was deemed acceptable. Those where the observations were clustered together around the same size store were rejected. In the ideal case, where there is perfect correlation between waste generation and employment, the intercept (a) is expected to be zero and the mean value should equal the regression slope (b). For further discussion of regression analysis the reader should consult Modern Elementary Statistics (ref. 6).

2.4.1 Estimates From Average Waste Weight Per Employee Data

For each SIC group of commercial business, the daily waste weight generated at each firm was divided by the number of employees to obtain the weight of waste per employee per day. An <u>average</u> estimated waste generation rate ($\pm$ 1 Standard Error) was calculated for the SIC sector from the sample data.

2.5 Estimation of Waste Generation by Commercial Sector in the Regional Municipality of Waterloo

The estimation of commercial waste generation for the Regional Municipality of Waterloo combines two kinds of information. First, various employment data are used to estimate total commercial employment and employment for various types of commercial activity in municipalities within the Region. Second, the field work provides estimates of the amount of waste generated per employee by type of commercial activity. By combining these two kinds of information the final estimate of commercial waste generation is obtained for the Region and its area municipalities.

Consider the breakdown of employment by municipality (Table 5). Note first, the great size range among spatial units. Kitchener is approximately ten times the size of Woolwich and almost 100 times larger than Wellesley. It is much more important to make accurate estimates for the larger places than for the smaller ones. Second, the share of employment in commercial jobs ranges from 30.2 percent in industrial Cambridge to 41.7 percent in Kitchener with its downtown concentration.

(Note: Familiarity with the local economic structure is required to make minor adjustments to Statistic Canada employment information where needed).

For the Region as a whole, the share of commercial jobs was 32.8 percent in the 1986 Census and 38.7 percent in 1989 according to the Region's Planning Department--a difference that reflects variations in definitions in the two data sets. Despite these differences, the regional employment survey permits us to estimate the share of regional commercial employment to be allocated to each municipality (see the fourth column titled % Jobs in Table 5). This should assist in estimating the share of commercial waste generation.

TABLE 5

ESTIMATE OF COMMERCIAL WASTE GENERATION
IN THE REGION OF WATERLOO
(AS STUDIED)

Place	1989 All Jobs[a]	Commercial[b]	%	Regional Share % Jobs	Waste (kg./wk.x 10^3)
Woolwich	6700	2900	43.8%	4.2%	61.7
Waterloo	42300	17500	41.3	25.3	371.8
Kitchener	79700	33200	41.7	47.9	703.8
Cambridge	43700	13200	30.2	19.0	279.2
N. Dumfries	1900	450	24.0	0.6	8.8
Wilmot	4000	1650	40.0	2.4	35.3
Wellesley	900	400	39.9	0.6	8.8
Regional Munic.	179300	69300	38.7	100.0	1469.4
(Kitchener CMA	174400	67300	38.6	97.1	1426.8)

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[a] Department of Planning, Regional Municipality of Waterloo, "Employment Survey, 1989".

[b] Jobs in the following categories: retail (502), repair (503), finance (601), services (602), technical (605) and social (606) organizations, recreation (700).

2.6 Sources of Potential Error in Employee Waste Generation Estimates

Table 6 lists the kinds of errors that will affect the accuracy of the employee waste generation estimates presented herein. An estimate of the magnitude and "direction" of the error is also given.

TABLE 6 ACCURACY IN WASTE ESTIMATION - SOURCES OF POTENTIAL ERROR

Type of Data	Type of Error	Magnitude of potential error (%)[1]	Bias	Level of Observation
Census Employment	Undercounting	2-5	negative	CMA, sector
	Misclassification	5 (?)	neutral	sector
	Employment Definition	5 (?)	positive	CMA, sector
	Location (JTW)[2]	5-10	small places	municipality
Labour Force Survey	Sampling Error (largely eliminated by tracking monthly estimates over time)	2-5	neutral	CMA
Regional Employment Survey	Reporting & Tabulating	up to 10	neutral	municipality, sector
	Misclassification	up to 10	neutral	sector
	Employment Definition	minor		municipality, sector
Waste Survey	Sampling Error	standard deviation up to 15%	neutral	store
	Measurement	5 (?)	?	store
	Classification	10	10 (?)	store

[1]Best estimate based on professional judgement (J. Simmons)
[2]Journey-to-work

SECTION 3

RESULTS

3.0 RESULTS

3.1 Waste Composition of Commercial Groups

A brief summary of the principal components in the waste streams from each of the two-digit SIC commercial groups is presented in the following sections. Each SIC group is listed separately. A complete waste composition for each of the samples is included in Appendix B. Table 7 summarizes the waste compositions of the 16 SIC groups.

The principal components of the waste streams sampled are in the following sections. Where more than one sample was taken, the mean percentage is shown ("n" indicates the number of samples sorted).

3.1.1 SIC 17--Leather and Allied Products Industries

SIC 1712--footwear manufacturer (n = 1)

The principal components, by weight, of the waste sampled from footwear manufacturing firms were:

textiles/leather/rubber	48.2%
wood	13.7%
OCC	12.0%

TABLE 7 AVERAGE WASTE COMPOSITION (%) DATA FOR COMMERCIAL SIC GROUPS*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Paper																
Newsprint	2.69%	0.60%	5.57%	16.78%	14.61%	1.38%	6.23%	12.76%	3.32%	7.63%	4.17%	14.44%	1.16%	6.56%	0.44%	1.22%
Fine Paper/CPO/Ledger	1.24%	70.88%	35.10%	3.18%	3.90%	5.24%	5.26%	5.19%	2.12%	5.76%	52.99%	2.74%	1.07%	0.14%	0.48%	1.95%
Magazines/Flyers		0.13%	2.51%		4.52%	1.46%	0.55%	0.08%	0.61%	1.02%	0.19%	0.52%				1.24%
Waxed/Plastic/Mixed	1.24%	8.99%	16.41%	2.22%	1.65%	0.89%	2.62%	3.75%	2.27%	2.33%	5.89%	4.30%	0.52%	2.43%	7.3%	5.99%
Boxboard	1.24%	2.15%	1.84%	10.68%	15.26%	1.95%	2.57%	2.57%	3.73%	4.98%	1.48%	5.61%	0.65%	5.23%	5.94%	7.79%
Kraft	3.52%	4.06%	0.52%	4.23%	1.64%	0.99%	3.49%	1.01%	5.56%	1.43%	1.15%	2.94%	0.36%	3.03%	4.66%	1.07%
Wallpaper																
OCC	12.01%	4.00%	6.31%	28.37%	28.65%	48.94%	14.8%	14.28%	7.39%	24.10%	4.35%	10.26%	8.84%	9.36%	27.97%	9.13%
Tissues	2.28%	0.65%	2.36%	4.34%	6.34%	0.42%	3.49%	6.44%	1.05%	2.57%	2.29%	5.03%	2.64%	3.97%	4.63%	6.38%
Glass																
Beer																
refillable							0.11%		0.15%			0.93%	0.18%	0.08%		0.03%
non-refillable	2.07%				0.65%							0.64%	2.17%			
Liquor & Wine containers				0.18%	0.32%		0.03%					4.44%	8.33%	0.09%		1.63%
Food Containers	2.07%	0.29%	2.22%	1.70%	1.58%	0.15%	0.47%	2.49%	0.95%	2.44%	5.35%	2.69%	9.85%	0.83%	7.24%	1.17%
Soft Drink												0.63%			0.46%	
refillable				0.29%								2.15%				
non-refillable		0.13%	0.44%	3.37%	0.45%	0.08%	0.55%	4.28%	0.61%		0.52%			0.17%		0.43%
Other Containers					0.04%		0.22%		0.08%							0.04%
Plate																
Other						1.23%						0.69%	0.94%	0.09%		0.2%
Ferrous																
Soft Drink Containers	0.15%	0.06%	0.28%	1.16%	0.46%	0.36%	0.45%	0.53%	0.65%	2.15%	0.96%	1.82%		0.39%	0.06%	0.72%
Food Containers		0.18%	2.24%	0.28%	0.16%	0.03%		0.14%	0.12%		0.22%	0.41%	1.11%	2.74%	3.64%	0.68%
Beer Cans																
returnable							0.13%					0.0005%			0.01%	
non-returnable					0.01%							0.46%				
Aerosol Cans						0.02%	0.15%		0.18%	0.17%		0.17%				0.04%
Other		0.45%		0.01%	0.02%	5.09%	25.09%	0.49%	11.91%	0.66%	0.26%	0.24%	0.04%		0.26%	1.29%
Non-ferrous																
Beer Cans																
returnable								0.04%	0.12%			0.53%	0.01%			0.02%
non-returnable						0.005%						0.01%				0.01%
American									0.004%			0.02%				
Soft Drink Containers	0.07%	0.04%	0.23%	0.34%	0.25%	0.06%	0.20%	1.83%	0.20%	0.61%	0.13%	1.16%	0.01%	0.02%		0.35%
Other Packaging												0.02%	0.03%			
Aluminum		0.08%		0.02%	0.01%	0.004%	0.02%	0.08%	0.01%	0.03%		0.18%	0.23%	0.02%		0.03%
Other				0.01%		0.01%	0.002%				0.16%	0.12%	0.03%			
Plastics																
Polyolefins	1.24%	1.02%	5.31%	5.21%	6.49%	6.76%	4.6%	25.05%	5.9%	5.44%	4.22%	6.57%	5.69%	4.28%	5.55%	4.59%
PVC																
Polystyrene	2.90%	0.08%	0.99%	0.69%	2.15%	0.42%	0.99%	0.77%	0.82%	2.34%	0.77%	2.08%	0.53%	2.55%	1.85%	2.24%
ABS						0.04%										
PET				0.06%								0.31%				0.15%
Mixed Blend Plastic		0.01%	0.82%	0.13%	0.28%		1.09%	2.03%	1.36%	0.29%	0.83%	0.29%	0.04%	0.36%	0.09%	0.04%
Coated Plastic			0.07%	0.15%			0.04%		0.02%			0.07%	0.01%		0.06%	
Nylon																
Vinyl		0.13%				0.13%										
Organic																
Food Waste/Rodent Bedding	4.55%	3.83%	14.40%	15.69%	2.24%	0.55%	3.07%	6.82%	1.23%	29.08%	13.24%	18.99%	54.76%	57.57%	28.26%	17.71%
Yard Waste																
Wood	13.66%	0.09%	0.70%	0.73%	2.36%	4.43%	3.89%		6.08%	0.25%		1.25%	0.63%			14.31%
Ceramics/Rubble/Fiberglass/ Gypsum Board/Asbestos						0.03%	0.43%			0.12%	0.18%	0.17%	0.19%			0.06%
Diapers				0.17%	0.15%		0.01%	0.32%	4.81%			1.24%				0.52%
Textiles/Leather/Rubber	48.23%	0.61%	0.22%		2.02%	11.67%	4.37%	3.88%	12.53%	5.62%	0.44%	2.69%	0.01%		0.03%	2.4%
Household Hazardous Wastes																
Paints/Solvents	0.28%	1.05%				0.09%	2.54%	5.04%	1.52%							
Waste Oils							6.25%		4.53%							
Pesticides/Herbicides																
Dry Cell Batteries						0.002%						0.08%				0.03%
Kitty Litter												2.01%				
Miscellaneous	0.84%	1.25%	0.42%	0.02%	3.80%	7.59%	6.48%	0.12%	20.17%	0.99%	0.21%	1.09%	0.0%	0.09%	1.07%	16.52%
TOTAL	100.00%	99.99%	100.01%	100.01%	99.98%	100.02%	100.92%	99.99%	100.00%	100.01%	100.00%	99.99%	100.03%	100.0%	100.0%	99.95%

LEGEND

Column #	Code	Industry Type
1	1712	(footware industry)
2	2819	(other commercial printing industry)
3	4813	(combined radio/television etc.)
4	6011	supermarket
	6012	grocery stores
	6019	specialty food stores i.e. health food
5	6111	shoe stores
	6149	other clothing stores i.e. leisure wear
	6151	fabric and yarn stores
6	6211	household furniture stores with appliances/furnishings
	6212	household furniture stores without appliances/furnishings
	6223	appliance, television, radio, and stereo repair shops
	6231	floor covering stores
	6239	other furnishing stores i.e. linen, glassware etc.
7	6311	"New" automobile dealers
8	6331	gasoline service station - specifically gas bars
9	6351	general repair garages
	6352	paint/body repair shops
	6353	muffler replacement shop
	6342	fire, battery, parts/accessories, stores
10	6521	florist shops
	6542	bicycle shops
	6562	watch/jewellery repairs shops
	6591	second-hand merchandise stores
11	7021	chartered banks
	7031	trust companies
	7051	local credit union
12	9111	hotels/motor hotels
	9112	motels
13	9211	licensed restaurant
14	9213	general take-out food services
15	9213	specialized take-out food services i.e. hamburger retaurants
16	9621	regular motion picture theatres
	9691	bowling alleys/billard parlours
	9692	amusement parks; carnivals
	9699	other amusement/recreational services i.e. horseback riding operations.

*Raw data in Appendix B

3.1.2 SIC 28--Printing, Publishing and Allied Industries

SIC 2819--printing (n = 3)

The principal component, by weight, of the waste sampled from printing, publishing and allied industries was:

fine paper 71.0%
(some of the fine paper was contaminated with ink)

3.1.3 SIC 48--Communications Industry

SIC 4813--combined radio/television firm (n = 1)

The principal components, by weight, of the waste sampled from communication firms were:

fine paper 35.1%
coated paper 16.4%
food waste 14.4%

The firm had cooking facilities for employees; staff worked in shifts and were on the premises throughout any 24 hour period.

3.1.4 SIC 60--Food, Beverage and Drug Industries (Retail)

a) SIC 6011--large supermarket (n = 1)
b) SIC 6012--mid-size grocer (n = 3)
c) SIC 6019--specialty food (n = 1)

The overall waste composition for the three kinds of food stores was consistent, but there were large variations in the relative proportions of the components.

The principal components, by weight, of the waste sampled from the three types of food stores were:

a) large supermarket:
food waste 53.0%
OCC 36.3%

b) mid-size grocers:
newsprint 27.1%
boxboard 14.6%
OCC 10.2%
food 8.2%

c) specialty food store:
OCC 75.0%

3.1.5 SIC 61--Shoe, Apparel, Fabric and Yarn Industries (Retail)

a) SIC 6111--shoe (n = 2);
b) SIC 6149--mens/womens clothing (n = 4);
c) SIC 6151--fabric/yarn (n = 2)

The major components, by weight, of the waste sampled for SIC 61 group were:

OCC 28.7%
boxboard 15.3%

In addition, the following observations were made regarding the principal waste components, from specific types of retail establishments:

a) shoe stores:

newsprint..... 14.4%
boxboard..... 26.6%
OCC.....38.7%

b) mens/womens clothing industries (retail):

newsprint 19.7%
OCC 22.3%

c) fabric/yarn industries (retail):

boxboard 15.5%
OCC 31.3%
tissues 15.3%

3.1.6 SIC 62--Household Furniture/Appliance and Furnishings Industries (Retail)

a) SIC 6211--household furniture/appliances/furnishings (n = 1)
b) SIC 6212--household furniture, no appli./furnishings (n = 1)
c) SIC 6223--appliance, television, stereo repair shop (n = 1)
d) SIC 6231--floor covering store (n = 1)
e) SIC 6239--other furnishings, e.g., linen, glassware (n = 1)

On average, the major components, by weight, of the waste steams sampled in this SIC group were:

OCC 48.9%
textile/leather/rubber 11.7%

3.1.7 SIC 63--Automotive Vehicles, Parts and Accessories Industries (Sales and Service)

a) SIC 6311--dealerships (n = 6)
b) SIC 6331--service stations/gas bars (n = 3)
c) SIC 634--parts/accessories (n = 1)
d) SIC 635--vehicle repair (n = 3)

The waste streams for SIC group 63 contained an assortment of vehicle accessories and parts, e.g., gaskets, cables, air filters, mixed automotive plastics, spark plugs, lubricants, and paint spray cans (aerosol). A number of waste materials were not included in the survey because they were not recovered from the general refuse disposal bins. Nevertheless, they are part of the solid waste stream generated by this SIC sector. These wastes appeared to be stock piled for separate disposal, e.g., tires, oil/solvents in drums, scrap metal, and lead/acid batteries. These items were not quantified in the present study and could be included in subsequent work.

The principal components, by weight, of the waste streams for the SIC 63 group of industries sampled were:

a) dealerships:

ferrous 25.8%
OCC 14.8%

b) service station:

polyolefins 25%
OCC 14.3%
newsprint 12.8%

c) parts/accessories:

OCC 13.8%

ferrous 22.2%

textile/leather/rubber 19.6%

miscellaneous..... 16.8%
(used auto parts, filters, etc)

d) vehicle repair:

wood 10.1%

miscellaneous..... 22.4%
(used auto parts, filters, etc)

3.1.8 SIC 65--Other Retail Industries

a) SIC 6521--florists (n = 3)
b) SIC 6542--bicycle shop (n = 1)
c) SIC 6562--watch, jewelry repair (n = 1)
d) SIC 6591--second hand store (n = 1)

OCC and food/plant wastes were the dominant components of this SIC group. The following outlines specific SIC groups which were sampled and their respective principal components, by weight:

a) florists:

organic material 50.25%

OCC 18.51%

b) bicycle shop:

OCC 53.6%

textile/leather/rubber 23.6%

c) watch/jewelry repair:

OCC 35.1%

newsprint 24.2%

fine paper 12.1%

d) second-hand store:

Fine paper	17.0%
box board	13.3%
polyolefins	13.3%
food wastes	13.3%

3.1.9 SIC 70--Finance and Insurance Industries

a) SIC 7021--chartered banks (n = 3)
b) SIC 7031--trust company (n = 1)
c) SIC 7051--credit union (n = 1)

The principal component, by weight, of the waste sampled from finance and insurance industries was:

fine paper	53.0%

It is significant to note that the trust company sampled produced no fine paper; in fact, this firm produced little waste. The total sample weight was 4.45 kg of which 52.1% was food waste. This may be the result of confidential documents being shredded and removed from the building. Future studies may consider addressing this diversion method of waste paper.

3.1.10 SIC 91--Accommodation Service Industries

a) SIC 9111--hotel/motor hotel (n = 4)
b) SIC 9112--motel (n = 2)

The presence or absence of restaurants partially determined the relative proportion of food wastes generated in this group; some establishments had efficiency units so food would also be processed/cooked at those locations.

The average principal components, by weight, of the waste streams of the hotels and motels sampled were:

food waste 19.0%
OCC ..... 10.3% (ranged: 1% to 35%)
newsprint 14.4%

3.1.11 SIC 92--Food and Beverage Service Industries

a) SIC 9211-licensed restaurants (n = 3)
b) SIC 9213--take-out restaurants (n = 3)
c) SIC--hamburger take-out/sit-down restaurants (n = 3)

The principal components, by weight, of the waste sampled from food and beverage establishments were:

a) licensed restaurants:
food waste 54.8%
glass 21.5%
OCC 8.8%

b) take-out restaurants:
food waste 57.6%
OCC 9.4%
newsprint 6.6%

c) "hamburger" take-out/sit down restaurants:
food waste 28.3%
OCC 28.0%
coated paper 7.3%

3.1.12 SIC 96--Amusement and Recreational Service Industries

a) SIC 9621--movie theatre (n = 1)
b) SIC 9691--bowling alley (n = 1)
c) SIC 9692--amusement park (n = 1)
d) SIC 9699--horseback riding (n = 1)

The four kinds of amusement activities are very different from each other and the composition of the waste streams have little in common. However, paper, food waste and plastics were predominant. Over the sector, the food waste component accounted for an average 17.7% of the refuse weight. The theatre generated a high percentage of coated paper (15.8%); wood waste, in the form of wood shavings (animal bedding) from the riding establishment was 45.6%.

3.2 Per Employee Waste Generation Rates

3.2.1 Overview Data Handling

For each company participating in the study, a daily, per employee waste generation rate was determined (kg per employee per day). The weight of waste generated by a company during one "work week" was divided by the number of days in their "work week", either 5, 6 or 7. The weight per day was divided by the total number of employees in the firm. An estimate of the employee waste generation rate per day for each SIC group, or sub-grouping, was obtained by averaging the information for all companies in the same SIC group or sub-grouping.

$$\frac{\text{(kg/wk)}}{6} = \text{weight per day}$$

$$\frac{\text{weight per day}}{\text{total no. of employees}} = \text{employee generation rate per day}$$

$$\frac{\text{sum: employee generation rates}}{\text{n (no. of employees)}} = \text{average employee generation rate per day}$$

For each two-digit SIC group or sub-grouping, the daily waste generation rate for each firm was also plotted against the number of employees. Linear regressions were calculated for the data and the resulting coefficients representing the employee waste generation rate (the coefficient b in the regression equation: $y = a + bx$) were compared with the estimates of daily waste generation for the SIC sector, determined by the averaging method.

In the following Sections (3.2.2 to 3.4), the per employee waste generation data are briefly evaluated with respect to the parameters of sample size, data scatter on the graph, regression coefficient and other anecdotal information which affected the decision to use either (1) the regression coefficient, b, or (2) the calculated average, for the SIC sector estimate of the rate of waste generation by employees in that sector.

Table 8 summarizes the estimation of waste generation presented in Sections 3.2.2 to 3.4 and should be referred to for the numerical calculations of the per employee waste generation rates. Figures 5 to 20, showing the distribution of the sample data for each SIC sector, are indicated in each sub-section heading. Numbered data points on these figures indicate sample numbers.

3.2.2 SIC Group 28--Printing, Publishing and Allied Industries (Table 11 & Figure 5)

Printing is considered a "light industry". Although the regression coefficient was 0.61, many data points were clustered at the low employment end of the scale. An average of all the data should be used as the waste generation estimate for the group, i.e., 4.9 kg/employee/day.

TABLE 8 ESTIMATION OF WASTE GENERATION BY COMMERCIAL SIC SECTORS

Commercial Sector Name	SIC code	Sample Size (n)	Regression Analysis a	b	r	$r2^{(1)}$	Data averaging (mean)	Per Employee waste generation estimator	Commercial Sector Explanation for estimator choice	Working days per week	Value for b or mean multiplied by working days per week (kg/employee/wk)
Retail											
Printing	28	10	76.56	.35	0.657	0.37	4.9±	mean	data points clustered	6	
Building Supply	56	9	27.15	5.7	0.976	0.95	6.23±1.08	b	r value high	6	34.2
Specialty Food	60	28	51.66	9.85	0.839	0.70	7.85±1.27	b	regression acceptable	6	55.1
Small-Mid-size[2]	60	15	-20.26	7.66	0.867	0.75	5.82±1.73	b	regression acceptable	6	
Super markets[2]	60	11	558.4	6.1	0.490	0.24	12.2 ±1.54	mean	r value too low	6	
Clothes	61	8	2.06	0.6	0.587	0.34	0.75±0.17	b	regression acceptable	6	3.6
Furniture	62	6	7.39	0.76	0.739	0.55	1.49±	mean	single large observation biased regression	6	8.9
Automotive:											
Dealers	631	14	27.02	0.87	0.861	0.74	1.41±0.17	b	large n; large numbers of employees	6	5.2
Gasoline	633	3	0.69	0.22	0.614	0.36	0.36±0.06	mean	small n	7	2.5
Repair	635	22	30.12	-0.22	-0.117	0.01	4.60±0.08	mean	r value too low; samples clustered	6	27.6
General Retail[3]	64	-	-	1.05	-	-	-	-		6	6.8[3]
Misc. Retail	65	9	-4.42	6.7	0.365	0.13	4.94±2.46	mean	r value too low	6	29.6
Finance									-		
Banks	70	5	1.14	0.16	0.825	0.68	0.29±0.08	b	regression acceptable	6	.96
Other[4]	71-77	-	-		-	-	0.61	mean	see footnote 4	5	3.0
Hotels											
No Restaurant Efficiency units	91	6	30.40	0.13	0.058	0.003	6.21±1.43	mean	r value too low	7	43.5
With Restaurants	911	6	132.02	0.63	0.155	0.02	1.71±0.22	mean	r value too low	7	12.0
Restaurants	92	6	30.36	3.01	0.773	0.60	4.29±0.37	b	regression acceptable	7	21.1
Licensed[5]	(92)	30	38.69	2.68	0.769	0.59	4.25±0.14	b	regression acceptable	7	-
Unlicensed[5]	(921)	28	30.36	3.01	0.773	0.60	4.33±0.39	b	regression acceptable	7	
Entertainment	96	6	46.7	0.41	0.776	0.58	2.08±0.68	mean	data points clustered;single value biases regression	7	14.6
Other service Industries[6]	97-99	-	-	0.16	-	-	0.29±0.08	b	see footnote 6	6	.96

[1] r^2 is the proportion of the variance of one variable y that can be explained by straight line dependance on the other variable x. For example, if r2=0.55, then the straight line dependance of the ys on the xs accounts for 55% of the variance of the ys.

[2] The weekly waste generation estimate for this group is based on 9.2 kg/employee/day (see explannation in Section 3.2.4)

[3] Estimate is the average of SIC 61 and 62

[4] "See Section 3.4 in text; data from Onatrio Ministry of Government Services." (Note: data from study of government office buildings are tentative

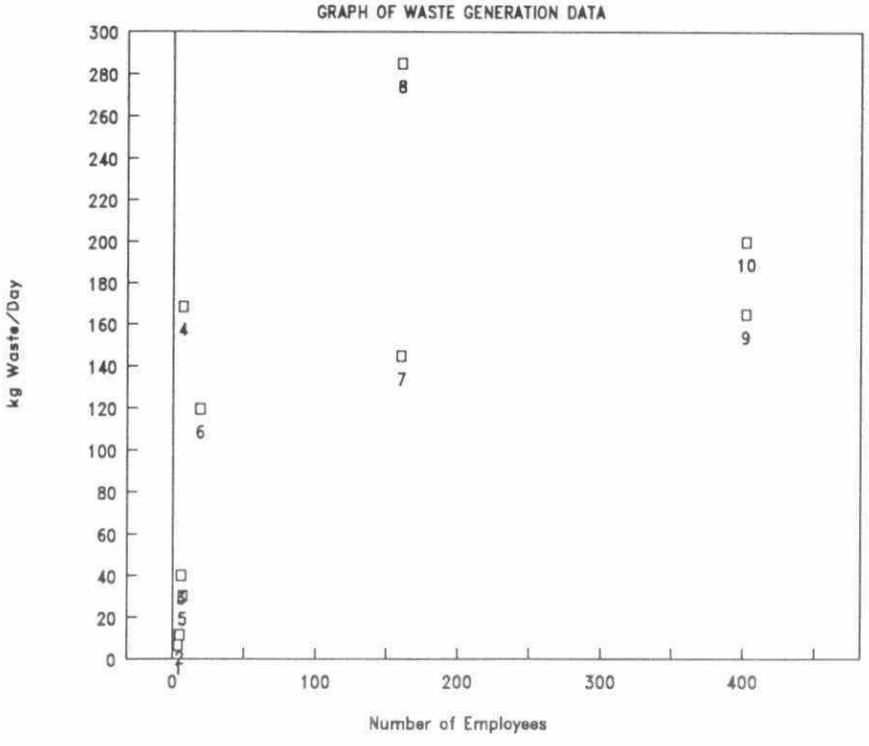
[5] All restaurant data

[6] Waste generation was estimated to be the same as that for bank (SIC Group 70)

TABLE 11 *SIC GROUP 28, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE PRINTING, PUBLISHING AND ALLIED INDUSTRIES*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	4	6.73	1.68
2	5	11.66	2.33
3	6	40.00	6.67
4	7	168.33	24.05
5	7	30.00	4.29
6	19	119.56	6.29
7	160	145.00	0.91
8	160	285.00	1.78
9	402	165.00	0.41
10	402	200.00	0.50
		AVERAGE	4.89
		+/- SE	2.247

FIGURE 5: SIC GROUP 28.



3.2.3 SIC Sector 56 - Metals, Hardware, Plumbing, Heating and Building Materials Industries (Wholesale) (Table 12 & Figure 6)

Although this SIC group is considered as wholesale by the classification system, retail hardware and building supply stores have general retail activities as part of their business. Because the regression coefficient, r = 0.97, was strong, the regression estimate for the waste generation rate was used: 5.7 kg/employee/day.

3.2.4 SIC Group 60 Food, Beverage and Drug Industries, Retail (Tables 13 & 14, Figures 7 & 8)

Per employee waste generation rates for small/mid-size markets and variety stores is lower than that generated by larger "chain-store" supermarkets. For smaller/mid-size stores (Figure 7), the estimated rate was 7.7 kg/employee/day; for larger markets (Figure 8), the average rate was 12.2 kg/employee/day. The regression coefficient for the small store was 0.869 and 0.49 for the large markets. Regression analysis did not give a reasonable estimate for supermarket waste generation because of the scattered distribution of the data.

We have attributed 2/3 of the employment in this group to small and mid-size stores; 1/3 to the larger supermarkets. The waste generation estimate for the group is: 2/3 x 7.7 kg/employee/day + 1/3 x 12.2 kg/employee/day = 9.2 kg/employee/day.

3.2.5 SIC Group 61 - Shoe, Apparel, Fabric and Yarn Industries, Retail (Table 15 & Figure 9)

The regression coefficient of .0587 was judged to be marginally acceptable, giving an estimate of the waste generation rate of 0.6 kg/employee/day.

TABLE 12 *SIC GROUP 56, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE METALS, HARDWARE, PLUMBING, HEATING AND BUILDING MATERIALS INDUSTRIES (WHOLESALE)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	7	10.00	1.43
2	7	11.67	1.67
3	19	133.30	7.02
4	19	175.00	9.21
5	23	115.00	5.00
6	25	156.67	6.27
7	25	206.67	8.27
8	26	295.00	11.35
9	150	875.00	5.83
		AVERAGE	6.23
		+/- SE	1.089

FIGURE 6: SIC GROUP 56

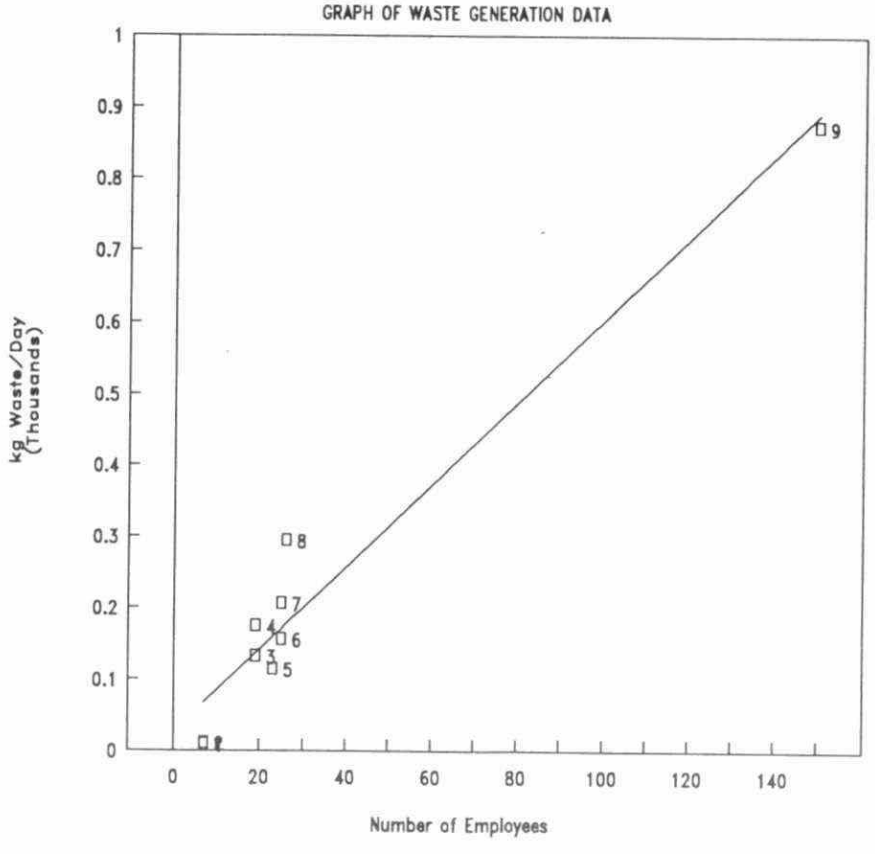


TABLE 13 *SIC GROUP 60, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE SMALL/MID-SIZE FOOD STORES (RETAIL)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	2	2.94	1.47
2	3	8.12	2.71
3	3	3.55	1.18
4	4	6.43	1.61
5	5	21.40	4.28
6	6	36.67	6.11
7	6	26.70	4.45
8	9	7.34	0.82
9	9	30.00	3.33
10	9	80.00	8.89
11	11	55.00	5.00
12	11	66.67	6.06
13	15	70.00	4.67
14	17	480.00	28.24
15	17	145.00	8.53
		AVERAGE	5.82
		+/- SE	1.725

FIGURE 7: SIC GROUP 60

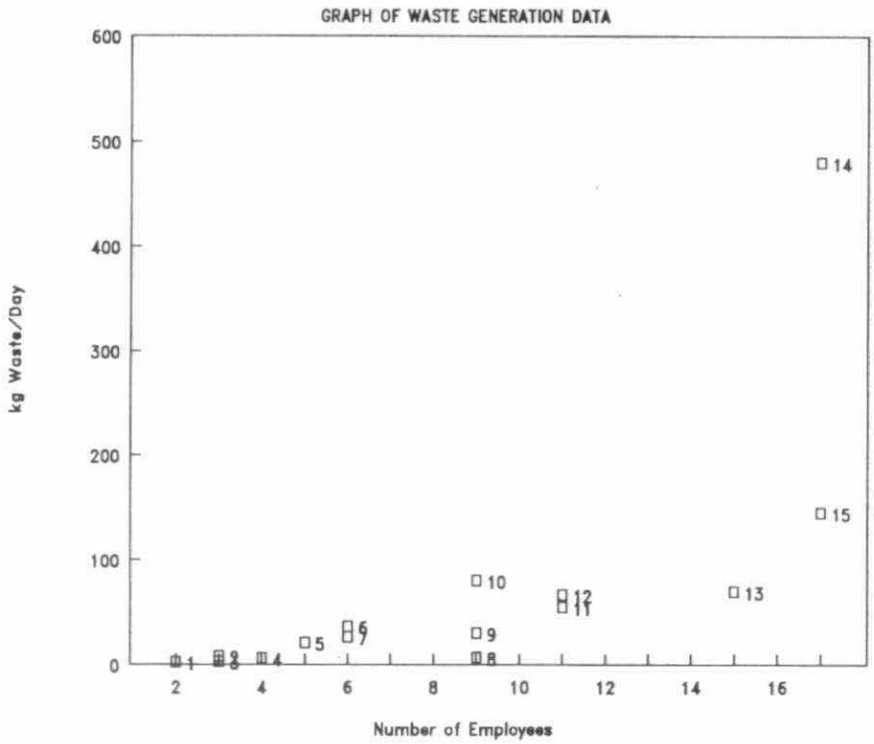


TABLE 14 *SIC GROUP 60, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE LARGE FOOD STORES (RETAIL)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	140	1721.20	12.29
2	37	686.30	18.55
3	142	1363.70	9.60
4	146	833.30	5.71
5	80	1089.30	13.62
6	95	1818.20	19.14
7	58	378.80	6.53
8	197	833.30	4.23
9	48	757.50	15.78
10	175	2651.50	15.15
11	110	1515.00	13.77
		AVERAGE	12.22
		+/- SE	1.535

FIGURE 8: SIC GROUP 60

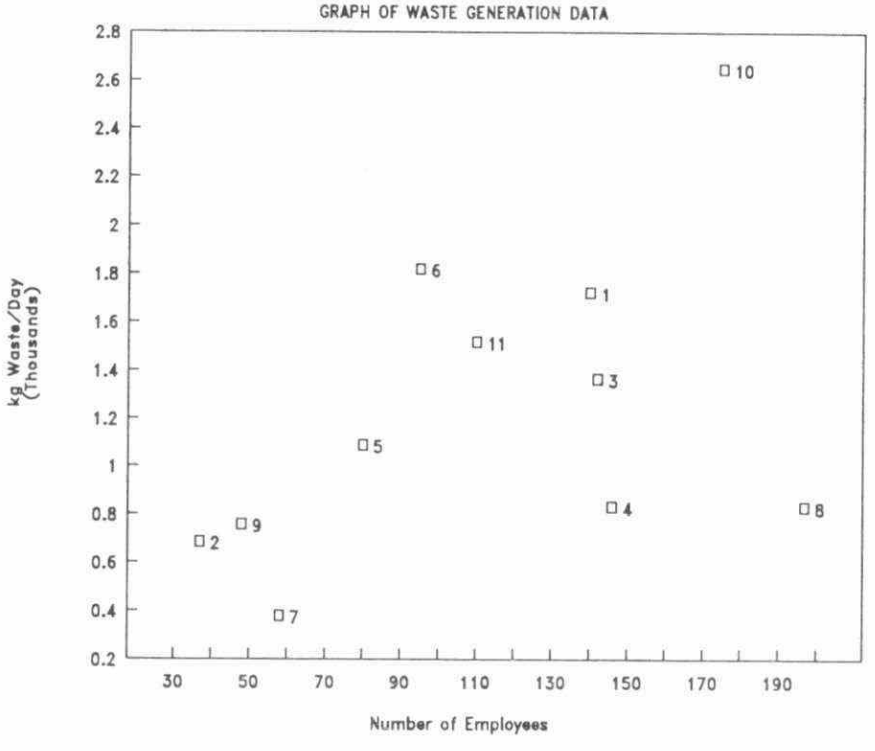
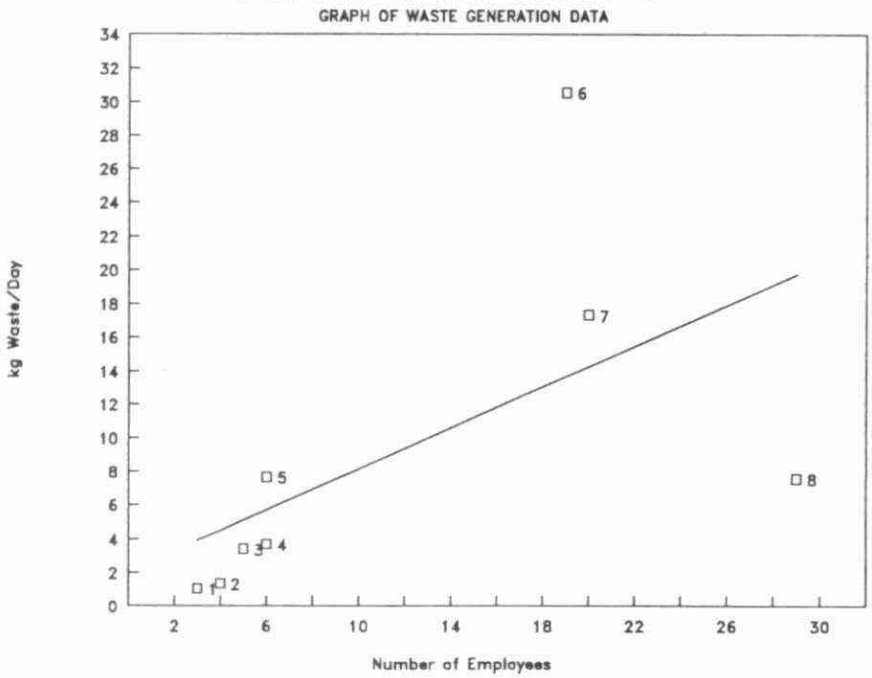


TABLE 15 *SIC GROUP 61, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE SHOE, APPAREL, FABRIC AND YARN INDUSTRIES (RETAIL)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	3	1.05	0.35
2	4	1.33	0.33
3	5	3.38	0.68
4	6	3.68	0.61
5	6	7.64	1.27
6	19	30.55	1.61
7	20	17.34	0.87
8	29	7.58	0.26
		AVERAGE	0.75
		+/- SE	0.170

FIGURE 9: SIC GROUP 61



3.2.6 SIC Group 62 - Household Furniture, Appliances, and Furnishings Industries, Retail (Table 16 & Figure 10)

A single datum for a large company biased the regression analysis so the average of all the data are used to estimate the waste generation rate which was 1.49 kg/employee/day.

3.2.7 SIC Group 63 - Automotive Vehicles, Parts and Accessories Industries, Sales and Service

3.2.7.1 SIC Group 631 - Automobile Dealers (Table 17 & Figure 11)

The study sample was relatively large (n = 14) and included firms with a large number of employees. The regression coefficient, r = 0.86, showed a strong correlation between waste generation and employment. Based on the regression, the waste generation is estimated to be 0.87 kg/employee/day.

Why use the regression value of 0.87 kg/employee/day and not the sample mean (1.4 kg/employee/day), when all but two of the sample data are greater than 0.87 kg/employee/day? In practical terms, these two estimates do not differ significantly from each other; the data plotted in Figure 11 suggest a strong relationship between employment and waste generation (regression coefficient, r = 0.74). Additional sampling would strengthen this relationship further.

3.2.7.2 Group 633 - Gasoline Service Stations (Table 18 & Figure 12)

The sample size was too small (n = 3) to use the regression estimate. Therefore, the sample average (0.36 kg/employee/day) was used as the waste generation estimate.

TABLE 16 *SIC GROUP 62, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE HOUSEHOLD FURNITURE, APPLIANCES AND FURNISHINGS (RETAIL)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	1	1.14	1.14
2	4	4.20	1.05
3	7	31.55	4.51
4	8	5.00	0.63
5	11	20.71	1.88
6	42	37.31	0.89
		AVERAGE	1.68
		+/- SE	0.591

FIGURE 10: SIC GROUP 62

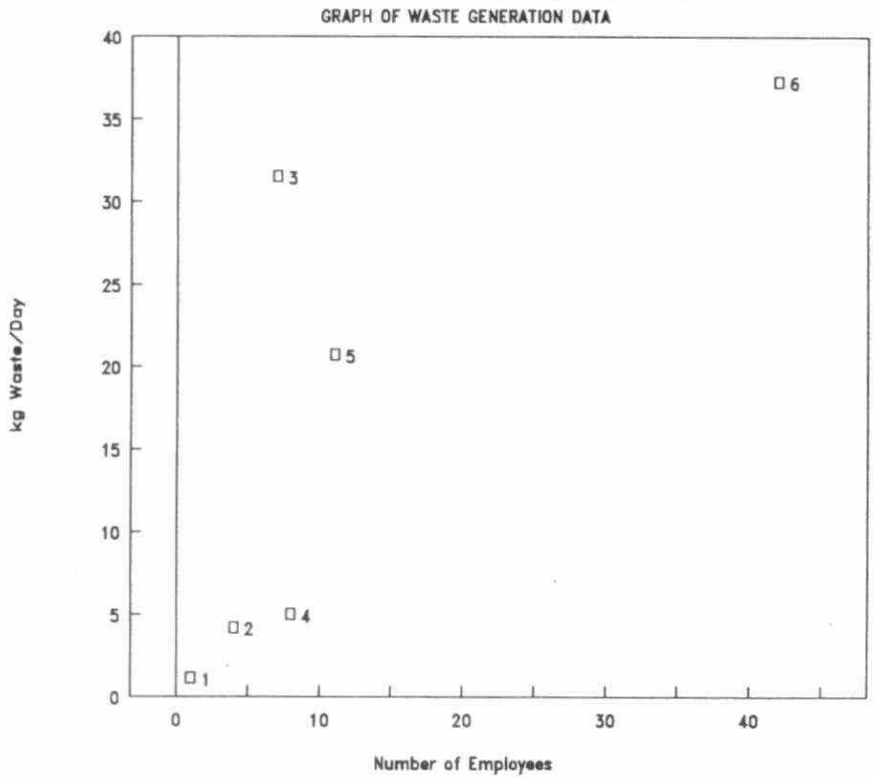


TABLE 17 *SIC GROUP 631, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE AUTOMOBILE DEALERS*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	3	1.71	0.57
2	18	47.52	2.64
3	19	33.86	1.78
4	40	46.93	1.17
5	40	25.06	0.63
6	43	95.00	2.21
7	43	85.00	1.98
8	69	105.00	1.52
9	69	95.00	1.38
10	75	69.70	0.93
11	85	160.00	1.88
12	85	105.00	1.24
13	170	170.00	1.00
14	170	150.00	0.88
		AVERAGE	1.41
		+/- SE	0.165

FIGURE 11: SIC GROUP 631

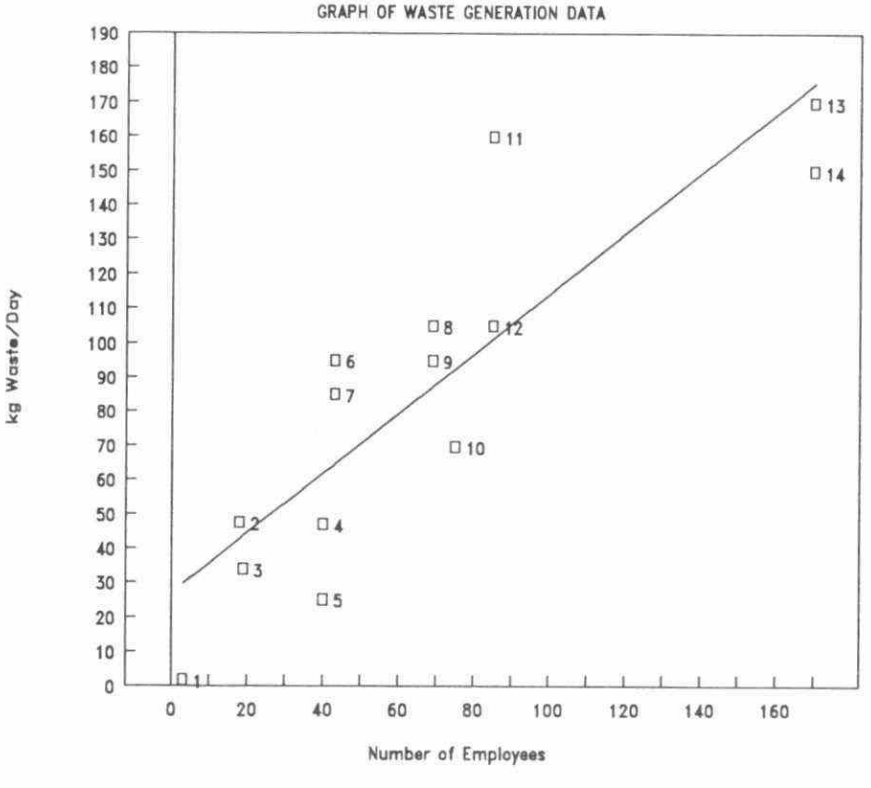
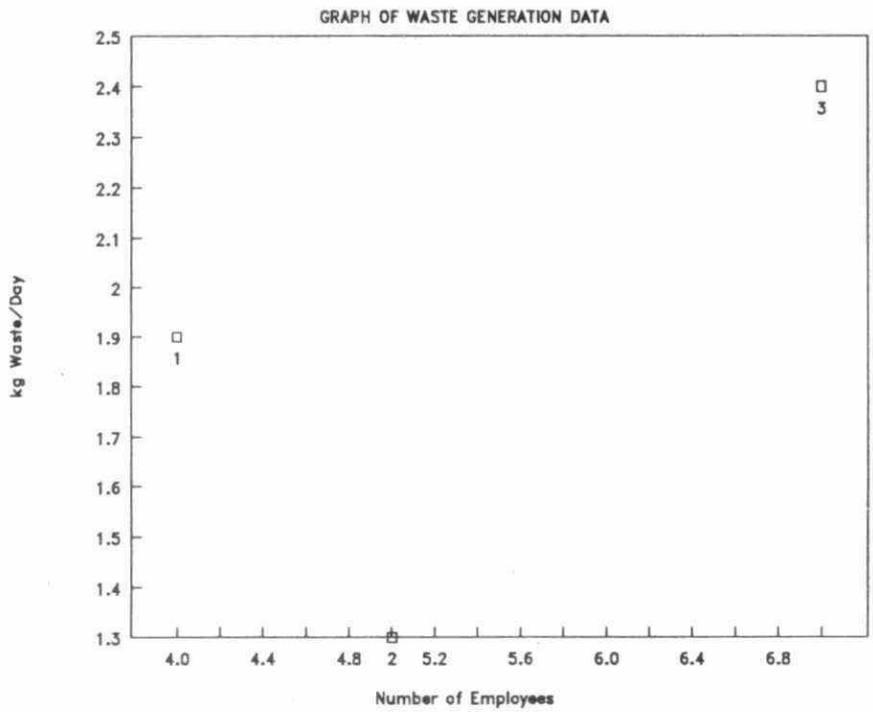


TABLE 18 *SIC GROUP 633, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE GASOLINE SERVICE STATIONS*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	4	1.90	0.48
2	5	1.30	0.26
3	7	2.40	0.34
		AVERAGE	0.36
		+/- SE	0.063

FIGURE 12: SIC GROUP 633



3.2.7.3 Group 635 - Motor Vehicle Repair Shops (Table 19 & Figure 13)

The wide range of weights over a very small employment range can be accounted for by the waste management practices of many firms. Although scrap metal bins were usually on the company's premises, metal items were routinely discarded in the general garbage bin.

Regression analysis was not applicable to the cluster of data. Therefore, the waste generation estimate of 4.6 kg/employee/day was obtained from averaging the data.

3.2.8 SIC Group 65 - Other (Miscellaneous) Retail Store Industries (Table 20 & Figure 14)

The regression coefficient, r = 0.365, was indicative of the wide scatter in the data. Therefore, the average of the sample data (4.94 kg/employee/day) was used.

3.2.9 SIC Group 70 - Deposit Accepting Intermediary Industries (Table 21 & Figure 15)

The regression of the data gave an acceptable regression coefficient of 0.825 and thus a regression estimate of 0.16 kg/employee/day.

3.2.10 SIC Group 91 - Accommodation Service Industries, Accommodation Without Restaurants but with many Efficiency Units (Table 22 & Figure 16)

The regression coefficient was too low to accept the regression estimate. The average of the sample data gave a waste generation estimate of 6.2 kg/employee/day. Although there was no restaurant associated with the facilities, the high waste generation rate is attributed to the efficiency units where long term residents were living and cooking meals. This type of accommodation becomes a residential dwelling and must be treated as a special waste stream.

3.2.11 SIC Group 91 - Accommodation Service Industries, Accommodation with Restaurants (Table 23 & Figure 17)

The regression coefficient was too low to accept the regression estimate. The average of the sample data gave a waste generation estimate of 1.7 kg/employee/day. The larger number of employees at these facilities led to a lower per employee wastes generation rate than for premises with efficiency units.

For SIC Group 91 as a whole, we assumed that hotels with restaurants might account for two thirds of the employment for this group.

3.2.12 SIC Group 92 - Food and Beverage Service Industries Licensed (Table 24 & Figure 18) and Unlicensed (Table 25 & Figure 19) for Alcoholic Beverages

The regression analyses for the licensed and unlicensed restaurants were similar (regression coefficient, r = 0.77), so the data were combined and analyzed together giving a regression coefficient, r = 0.77. The regression estimate for waste generation for the combined data was 3.0 kg/employee/day.

3.2.13 SIC Group 96-Amusement and Recreational Service Industries (Table 26 & Figure 20)

The data were clustered at the employment end of the scale, so use of the regression value was not appropriate. The sample average of 2.1 kg/employee/day was used as the waste generation estimate.

3.3 Wastes Generation Estimates for Other SIC Groups

SIC Group 64 (General Retail Merchandising Industries) includes department stores. A waste generation estimate for these firms was the average of the estimates for similar retail SIC Groups 61 and 62; i.e., 1.14 kg/employee/day.

TABLE 19 *SIC GROUP 635, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE MOTOR VEHICLE REPAIR SHOPS*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	1	0.88	0.88
2	3	8.96	2.99
3	3	25.00	8.33
4	3	21.67	7.22
5	3	38.33	12.78
6	4	10.84	2.71
7	4	20.00	5.00
8	5	13.33	2.67
9	6	61.67	10.28
10	6	58.33	9.72
11	7	17.08	2.44
12	8	81.66	10.21
13	8	35.00	4.38
14	8	65.00	8.13
15	10	31.67	3.17
16	10	31.66	3.17
17	10	15.00	1.50
18	11	26.67	2.42
19	13	6.67	0.51
20	13	11.67	0.90
21	16	24.08	1.51
22	63	14.97	0.24
		AVERAGE	4.60
		+/- SE	0.801

FIGURE 13: SIC GROUP 635

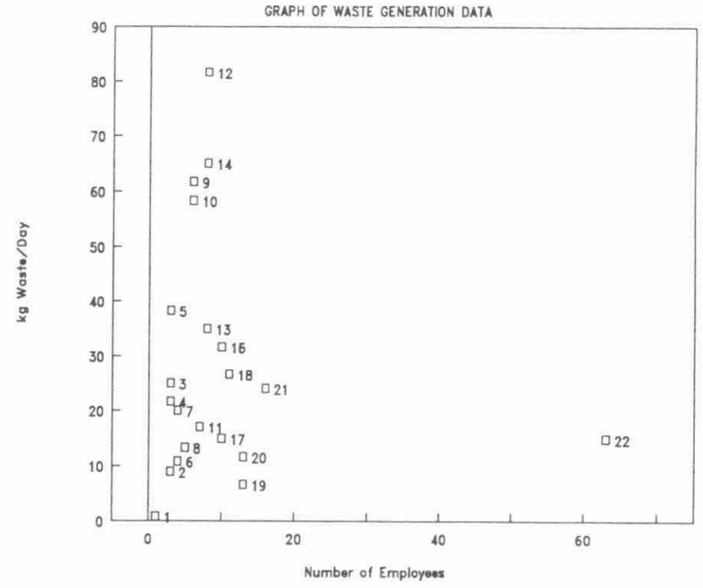


TABLE 20 *SIC GROUP 65, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE OTHER RETAIL STORE INDUSTRIES*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	2	2.25	1.13
2	2	0.47	0.24
3	3	0.69	0.23
4	4	4.38	1.10
5	5	90.00	18.00
6	6	6.30	1.05
7	7	32.00	4.57
8	7	122.50	17.50
9	9	5.75	0.64
		AVERAGE	4.94
		+/- SE	2.460

FIGURE 14: SIC GROUP 65

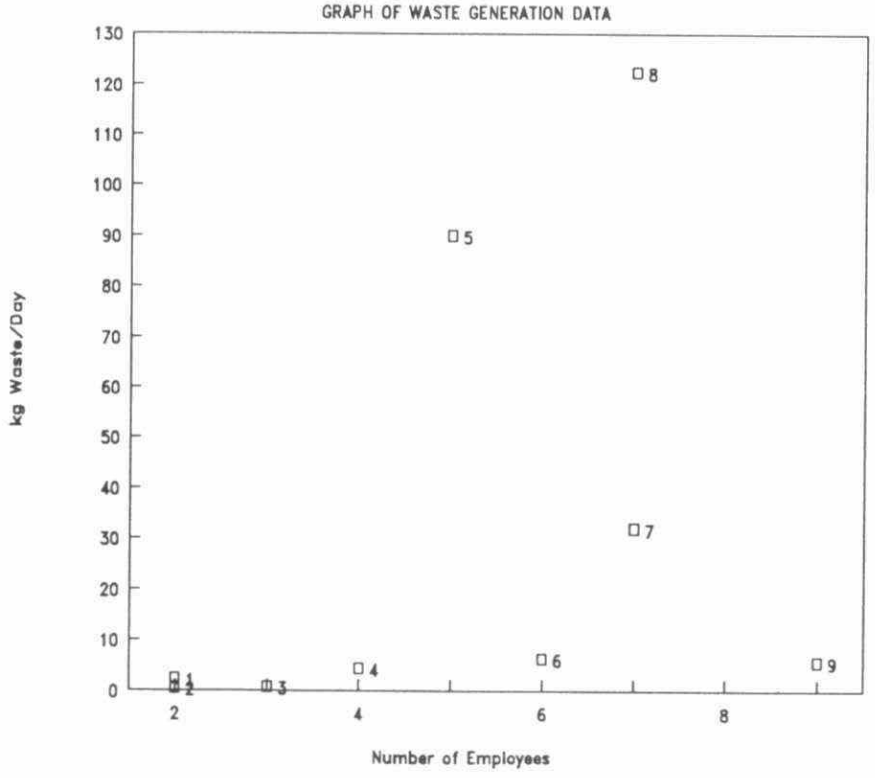


TABLE 21 *SIC GROUP 70, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE DEPOSIT ACCEPTING INTERMEDIARY INDUSTRIES*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	5	0.43	0.09
2	5	2.50	0.50
3	7	3.35	0.48
4	23	3.86	0.17
5	26	5.80	0.22
		AVERAGE	0.29
		+/- SE	0.084

FIGURE 15: SIC GROUP 70

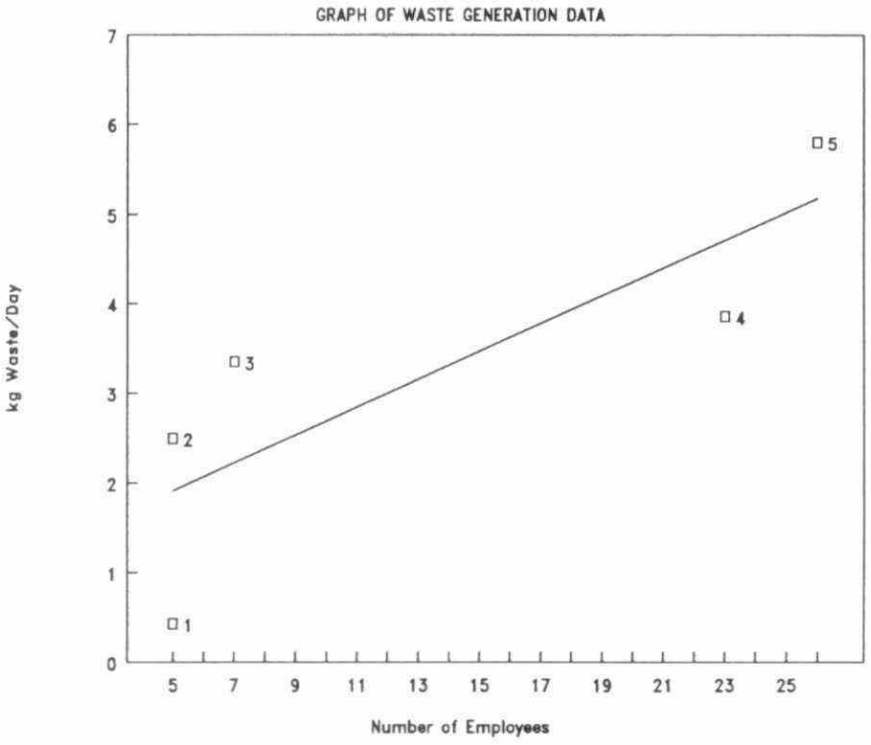


TABLE 22 *SIC GROUP 91, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE ACCOMMODATION SERVICE INDUSTRIES WITHOUT RESTAURANTS (MOTELS)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	2	7.10	3.55
2	2	14.00	7.00
3	4	24.90	6.23
4	6	55.70	9.28
5	6	61.40	10.23
6	27	25.80	0.96
		AVERAGE	6.21
		+/- SE	1.425

FIGURE 16: SIC GROUP 91

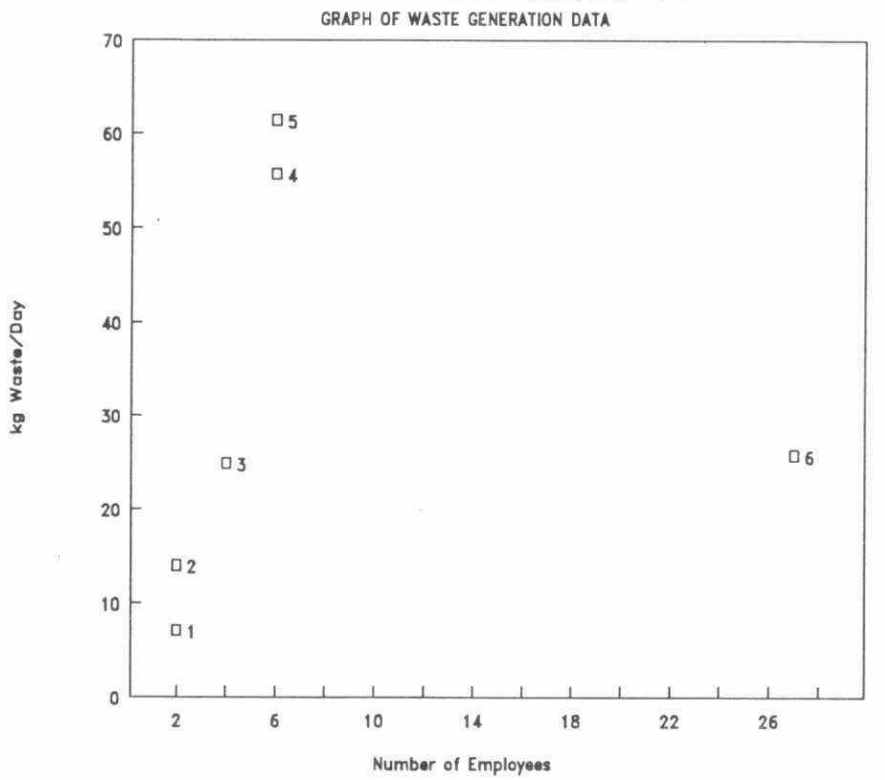


TABLE 23 *SIC GROUP 91, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE ACCOMMODATION SERVICE INDUSTRIES WITH RESTAURANTS (HOTELS)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	104	160.00	1.54
2	104	215.00	2.07
3	130	320.00	2.46
4	130	246.67	1.90
5	130	132.50	1.02
6	145	188.00	1.30
		AVERAGE	1.71
		+/- SE	0.216

FIGURE 17: SIC GROUP 91

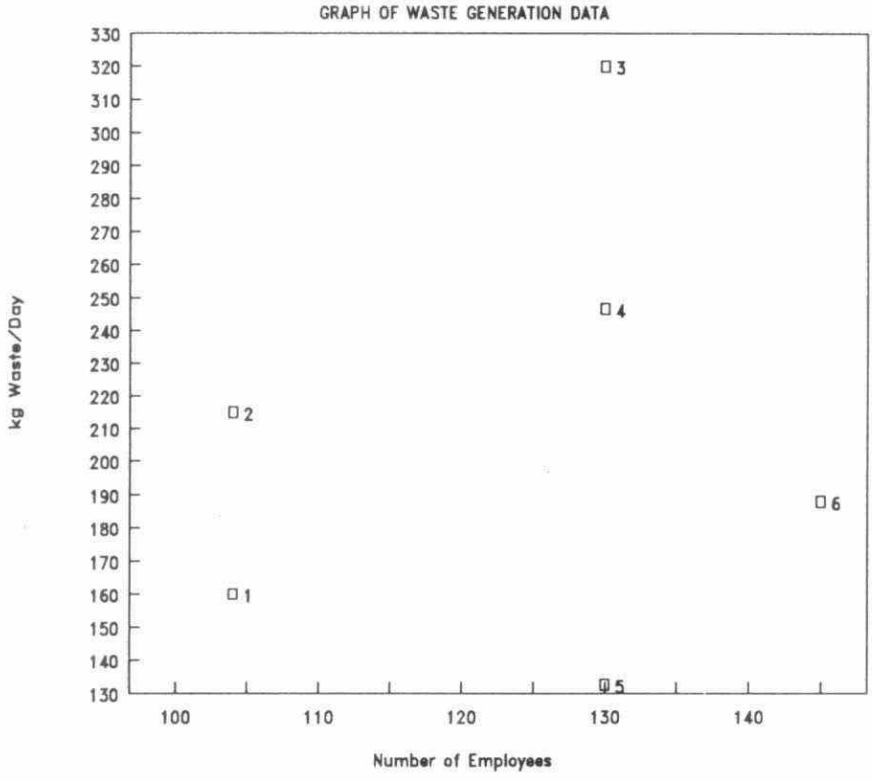


TABLE 24 *SIC GROUP 92, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE FOOD AND BEVERAGE SERVICE INDUSTRIES (LICENSED FOR ALCOHOLIC BEVERAGES)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	3	9.40	3.13
2	6	77.50	12.92
3	8	24.30	3.04
4	8	20.70	2.59
5	14	25.70	1.84
6	15	213.33	14.22
7	15	230.00	15.33
8	18	42.90	2.38
9	20	60.00	3.00
10	20	72.50	3.63
11	24	75.70	3.15
12	24	68.60	2.86
13	43	44.90	1.04
14	51	215.70	4.23
15	51	186.00	3.65
16	49	134.30	2.74
17	49	152.90	3.12
18	50	184.00	3.68
19	50	182.90	3.66
20	50	168.60	3.37
21	55	193.60	3.52
22	55	210.00	3.82
23	55	195.00	3.55
24	61	230.00	3.77
25	61	208.00	3.41
26	75	345.00	4.60
27	75	315.00	4.20
28	82	265.00	3.23
29	82	186.67	2.28
30	149	223.33	1.50
		AVERAGE	3.41
		+/- SE	0.136

FIGURE 18: SIC GROUP 92

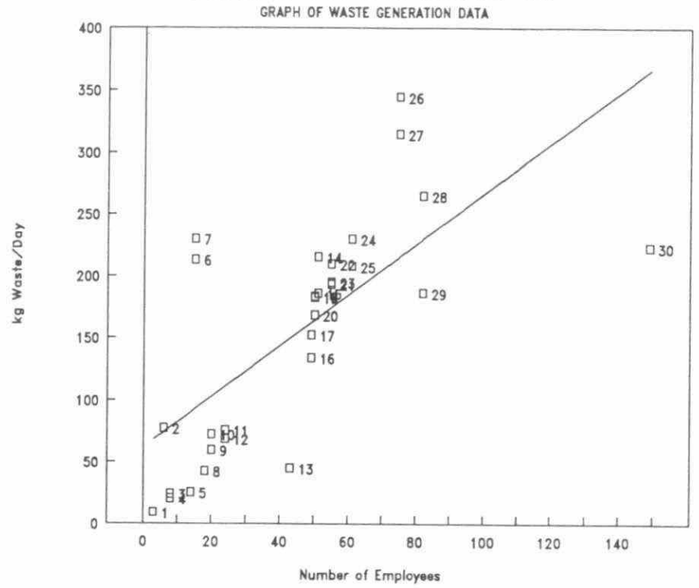


TABLE 25 *SIC GROUP 92, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE FOOD AND BEVERAGE SERVICE INDUSTRIES (UNLICENSED)*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	4	2.30	0.58
2	10	71.40	7.14
3	10	71.40	7.14
4	11	73.33	6.67
5	11	46.67	4.24
6	14	84.40	6.03
7	14	35.00	2.50
8	15	75.00	5.00
9	15	95.00	6.33
10	20	143.33	7.17
11	20	146.66	7.33
12	20	62.50	3.13
13	20	103.33	5.17
14	20	77.50	3.88
15	20	18.89	0.94
16	20	50.00	2.50
17	21	68.60	3.27
18	23	122.00	5.30
19	30	56.90	1.90
20	31	88.60	2.86
21	31	90.00	2.90
22	32	42.50	1.33
23	39	67.70	1.74
24	65	390.00	6.00
25	65	390.00	6.00
26	75	430.00	5.73
27	98	420.00	4.29
28	98	404.30	4.13
		AVERAGE	4.33
		+/- SE	0.391

FIGURE 19: SIC GROUP 92

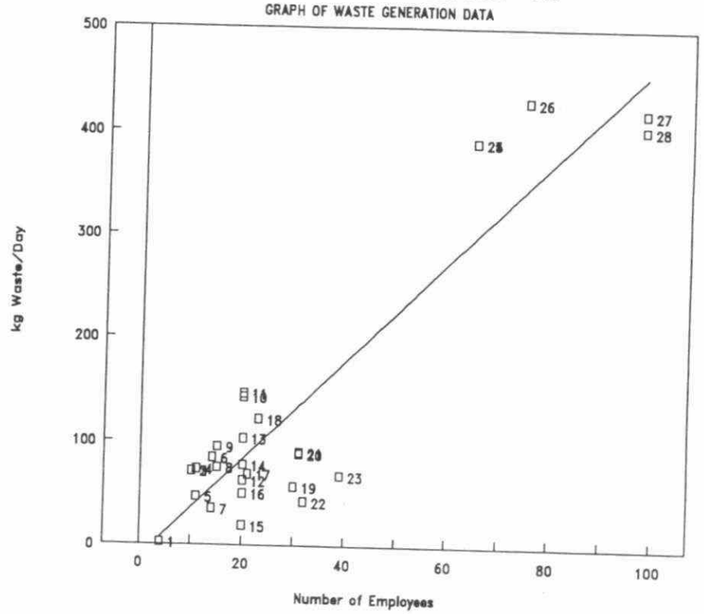
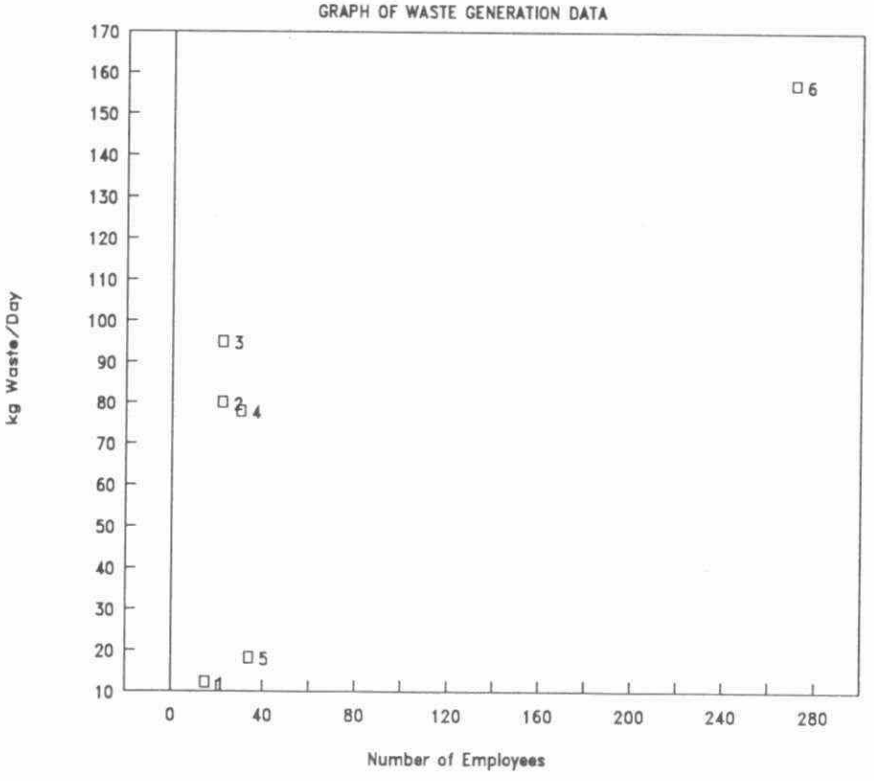


TABLE 26 *SIC GROUP 96, WASTE GENERATION DATA (KG/EMPLOYEE/DAY) FOR THE AMUSEMENT AND RECREATIONAL SERVICE INDUSTRIES*

Sample #	Total # of Employees	kg Waste/Day	kg Waste/ Employee/Day
1	15	12.20	0.81
2	22	80.00	3.64
3	22	95.00	4.32
4	30	77.90	2.60
5	34	18.20	0.54
6	271	157.40	0.58
		AVERAGE	2.08
		+/- SE	0.682

FIGURE 20: SIC GROUP 96



For SIC Groups 71 to 77 (Finance, Insurance and Business Service Industries) wastes generation data were obtained from a study that was conducted for the Ontario Ministry of Government Services (personal communication: Ms. Marook Sidhwa, Regional Coordinator - Toronto East, Waste Management Program, November, 1990). The average wastes generation rate was reported as 1.34 lb/employee/day or 0.61 kg/employee/day.

Because of the similarities in activity, the waste generation estimates for SIC Groups 97 to 99 (Personal and Household Service, Membership Organizations and Other Service Industries) were estimated to be the same as that for banks (SIC Group 70).

As earlier discussed, Table 8 provides a summary of the estimation of waste generation by commercial sectors as discussed above.

3.4 Sources of Potential Error in Employee Waste Generation Estimates

Error in the estimates of waste generation for a municipality can occur in two ways. First, the labelled Waste Survey in Table 6 is derived from the evaluation of ratios of waste generation per employee (Section 3.2.1). The error occurs in the sampling procedure, due to store-to-store differences in the ratios; this error can be reduced by increasing the sample size. The results presented in Table 8 suggest that the standard deviation ranges from 10 to 30%.

Difficulty in identifying and clarifying the correct type of business SIC can also contribute to that error, and is more difficult to evaluate. The error depends on the significance of identifiable differences in subtypes of commercial activities, perhaps segmented by location or brand names or product mix. A store incorrectly identified could lead to a sizeable error in a small sample. In this study, local business directories provided the SIC for the businesses. Measurement errors, e.g., weight of waste, should be relatively minor.

The second form of error (possibly embodied in the remainder of Table 6) is related to the estimation of total commercial activity in various sectors, based on various data sources. Each data source has its own problems. Unlike the waste study data, these errors cannot be reduced by increasing the sample size. Census data are comprehensive, but begin with the undercounting bias that averages this percent across the population as a whole. There may be other systematic errors in reporting the SIC; such as, whether the person is actually working, or the location of the work place. Most of the error in the Labour Force survey is derived directly from the sample size, since there is not detailed information on location or SIC. The regional employment survey provides greater spatial detail but carries a high level of error due to non-response and errors in SIC or number of employees. Local governments are not professional data gathering agencies and employers are not required to respond.

The present study is thus an exploratory one, and the sampling errors in the waste survey predominate. As more information is integrated from additional work, and samples become larger and more precisely targeted, these waste survey errors can be reduced and made small, relative to the problems of employment estimations and projections.

3.5 Estimation of Commercial Waste Generation in the Regional Municipality of Waterloo

Table 9 disaggregates the various SIC categories from Statistics Canada to conform to the groups used in the present field study. Note that much of the commercial activity can simply be grouped together as office employment. The field study has focused on the variance in waste generation among retail and service activities. The table also contains estimates of total regional employment for each of the commercial sectors. To obtain an estimate of the Region's employment from the CMA data in the Census we simply multiplied by 1.028 to reflect the slight differences in the spatial definition of the study area (i.e., the Region's boundaries are slightly larger than those of Statistic Canada for the Region). To convert the

1986 employment to 1990 employment, we multiplied by the estimated commercial employment growth of 15 percent. The application of growth rates in this manner does not account for fluctuations occurring as a result of economic fluctuations, such as during a periods of recession. The joint effect of these two adjustments is 18.2 percent. These employment estimates are combined with the waste generation per employees to estimate total commercial waste for the SIC group listed.

Finance and service industries have been estimated to produce nearly 40% of the total commercial waste. This may be due to the high number of people employed in these sectors with the Region.

The data in the right hand column of Table 9 are estimates of weekly waste generation rates (kg/employee/week) for 13 commercial SIC Groups. The weekly per employee waste generation estimate for each SIC group was multiplied by the total regional employment for the group to obtain the weekly waste contribution (kg/week) from the SIC group. These calculations are shown in Table 8 (note: the kg/wk are presented in 1,000s, i.e., the actual values are 1,000 times higher than the number entered in the table; e.g., 342 x 1,000 = 342,000.

The total estimated weight generated by the commercial sector is 1,469,400 kg/wk, or approximately 1,469 tonnes/wk (76,388 tonnes/year). In 1989, the total waste landfilled in the Region of Waterloo was 439,000 tonnes. Waste from commercial sources is therefore estimated at 76,388/439,000 x 100 or 17.4% of the total tonnage.

Table 5 relates the size of the commercial work force in each area municipality with the proportion of waste generated by the respective municipalities in the Region. Kitchener, Waterloo and Cambridge account for approximately 92% of the commercial waste generated in the Region.

TABLE 9

ESTIMATES OF COMMERCIAL WASTE GENERATION

Activity	Employment CMA (1986)	Employment Region[a] (1990)	Waste Generation kg./empl./wk.	Total Waste kg./wk. x 10^3
Retail				
Food (SIC 60)	5240	6195	55.2	342.0
Clothes (61)	1875	2215	3.6	8.0
Furniture (62)	1210	1430	10.1	14.4
Auto (63)	4570	5400	12.6	68.1
General (64)	3235	3825	6.8[b]	26.0
Misc. Retail (65)	2925	3455	29.6	102.3
Bldg. Suppl. (56)	1265	1495	34.2	51.1
Non-store (69)	500	590	1.0[c]	0.6
Sub-total	20820	24605	-----	612.5
Finance and Services				
Banks (70)	2455	2900	1.0	2.9
Other Fin. (71-77)	16050	18970	3.0[f]	575.8
Services (97-99)	7685	9080	1.0[c]	9.1
Sub-total	26190	30950	-----	587.8
Hotels(91)				
No Restaurant[d]	440	520	43.5	22.6
With Restaurant	875	1035	12.0	13.0
Sub-total	1315	1555	-----	35.6
Restaurants(92)				
Licensed[e]	4670	5520	21.1	116.5
Unlicensed	2335	2760	21.1	58.2
Sub-total	7005	8280	-----	174.7
Recreation(96)	1525	1800	2.1	3.8
Total Commercial for SIC Groups Listed Above	56855	67190		1469.4

[a] 1986 CMA totals multiplied by 1.182; reflecting 2.8 percent adjustment of Region to CMA, plus an estimated growth rate of commercial employment of 15 per cent.

[b] The average of categories 61 and 62.

[c] Because of the similarities in activities, the employee waste generation estimates for non-store and service commercial entities were estimated to be the same as banks.

[d] Estimated as one-third of hotel employment.

[e] Estimated as two-thirds of restaurant employment.

[f] Estimate from Ministry of Government Services (personal communications with M. Sidhwa; note that this estimate is tentative and awaiting confirmation).

Table 10 presents a comparison of the per employee waste generation rates estimated in the present study and those estimated by Rhymer & Green (ref. 14). A discussion of these results is provided in Section 4.0.

TABLE 10

COMPARISON OF PER EMPLOYEE WASTE GENERATION RATES:
RHYNER & GREEN (REF. 14) AND PRESENT STUDY[1]

SIC[2]	Description	Rhyner & Green (ref. 14) tonnes/emp/yr	Rhyner & Green (ref. 14) kg/emp[3]/day	Present study kg/emp/day
50-51	Wholesale trade	1.70	6.5[4]	
52	Retail building materials	1.44	4.6[5]	5.7
53	Retail general merchandise	0.25	0.8[5]	1.1
54	Retail Food	1.97	6.3[5]	9.2
55	Auto sales, service	0.41	1.3[5]	0.9-4.6
56	Retail apparel	0.41	1.3[5]	0.6
57	Furniture	1.06	3.4[5]	1.7
58	Eating & drinking place	2.07	5.7[6]	3.0
59	Miscellaneous retail trade	0.89	2.0[5]	4.9
60-67	Financial operation	1.18	4.5[4]	0.2-0.6
70	Hotels	1.95	5.4[6]	1.7-6.2
72	Personal services	0.38	1.5[4]	
73	Business services	0.68	2.6[4]	
76	Miscellaneous repair	1.51	4.8[5]	
79	Amusement recreation	0.66	1.8[6]	2.1
89	Miscellaneous services	0.68	2.2[5]	
90	Government[7]	0.68	2.6[4]	

[1] data from Table 7 herein.

[2] Numbering for the U.S. SIC code differs from the Canadian code.

[3] calculated from Rhyner & Green data for tonnes/emp/yr.

[4] five day work week (260 days/yr): tonnes/emp/yr ÷ 260 work days/yr x 1000 kg/tonne = kg/emp/day.

[5] six day work week (312 days/yr): tonnes/emp/yr ÷ 312 work days/yr x 1000 kg/tonne = kg/emp/day.

[6] seven day work week (365 days/yr): tonnes/emp/yr ÷ 365 work days/yr x 1000 kg/tonne = kg/emp/day.

[7] Value not reported; Miscellaneous Services value used.

SECTION 4

DISCUSSION

4.0 DISCUSSION

4.1 Overview of the Method

Waste Composition

Table 7 summarizes the waste streams from the 16, two-digit SIC commercial sectors. Because these are average percentages of the composition of waste samples collected from more than one company, the total will not add up to 100%. It is apparent that paper predominates as the major category of waste. In most cases, OCC is the largest fraction of the paper waste. Food waste from restaurants and markets is a significant portion of the waste streams from these businesses.

The waste composition data are presented as percentages of the total composition and indicate the relative proportion, i.e., the general picture of various waste materials generated by commercial businesses. However, to be useful to waste management personnel in municipalities, the waste composition data must be accompanied by quantitative information on waste generation. For example, if OCC is identified as a significant percentage of the waste from a particular commercial business the following questions must be addressed:

1) How many similar businesses are there in the municipality?

2) How much OCC is generated by all of those businesses in the municipality?

3) What percentage of the waste stream is represented by OCC in the other commercial groups?

4) What is the total tonnage of cardboard from all groups?

Waste Quantity

DeGeare & Ongerth (ref. 3) reported a relationship between the quantity of waste generated by commercial businesses and business employment. In about 50% of the two-digit SIC groups that we studied, reasonable regression coefficient values (r) for the relationship between waste generation and employment were obtained (Table 8). In the case of the remaining SIC sectors, one or more reasons were proposed to explain the poor regressions; e.g., sample size of businesses was too small; data were clumped; interfering waste management practices; etc. In these cases the average per employee waste generation rates were used in calculations rather than the value for 'b' (slope) in the regression equations.

On the basis of the DeGeare-Ongerth relationship, the waste generation rates for retail commercial activities were estimated on a Region-wide scale, using suitably adjusted Canada Census data for the Regional Municipality of Waterloo (see Section 2.0).

Referring to the OCC example above (i.e., where a relatively high proportion of OCC is identified in the commercial waste streams in a municipality) waste management planners can estimate the quantity of OCC generated by all of the commercial groups in a municipality, once they know the following: (1) per employee waste generation rate for each SIC group; (2) the total employment in the commercial groups within the municipality; and (3) the quantity of OCC in each of the waste streams that were studied as part of this waste composition study, i.e., those commercial activities that are related to residential consumption. (Note: this forms the basis of estimates in data base projections.)

4.2 Evaluation of the Methods

4.2.1 Waste Composition of Commercial Businesses

Timing of the Study

If the waste composition study had been conducted two or three years ago in the Region of Waterloo, we could probably have stated with certainty that the composition of the waste stream had been adequately assessed by our study methods. Presently however, waste reduction and waste diversion are being more frequently practised as company policy or by conscientious employees who take recyclable materials from places of work to recycling locations in municipalities or home to their Blue Boxes. We expect that these activities have reduced the quantities of some materials that otherwise would have been discarded in the bulk refuse containers. The impact of these waste diversion activities would be greater in companies with fewer employees than in those with larger employment. We cautiously regard the composition data as a best estimate under constantly changing circumstances. This study did not attempt to quantify the amount of materials being diverted from a company's waste stream; the waste composition, therefore, does not include those materials which were being diverted (if any) through any outside agencies.

Because of the scope of the work, it was not possible to design a waste sampling program that would permit the collection of a sufficient number of samples so that statistical analyses could be applied to the waste composition data. It must be pointed out that this study was a prerequisite study; the level of variance between the estimated and actual waste composition is not known. More field work must now be done in other municipalities to augment the data contained herein.

Waste Composition Variability

Does one expect a large variation in the composition of the waste streams generated by commercial businesses throughout the year? Given the "predictable character" of retail activities carried on within each SIC group, there is no reason to expect a significant variation in the composition in the waste generated by business within a given sector.

It is expected, however, that there may be variations in the quantity of waste, with increases occurring at certain times of the year, e.g., Christmas holidays, year-end inventory, etc. However, as was pointed out earlier (see Section 2.0), retail activity is dependent on consumer habits. Consumer waste generation is reportedly consistent, varying +/-10% of a yearly average over three quarters of the time (cf. Vesilind & Rimer, ref. 17). The implication of this consistency is that seasonal variations in residential refuse generation patterns will be mirrored in many of the commercial retail sectors. Financial institutions may also exhibit predictable fluctuations in waste composition and/or quantity, that may be correlated with cyclic business-related activities.

4.2.2 Per Employee Waste Generation

Waste Collection

Unloading waste from refuse bins by hand was unpleasant, time consuming and very awkward, particularly for compacted refuse. Nevertheless, this method enabled us to obtain the total weight of refuse discarded by 65 of the businesses surveyed in the study with four samples from "light industry". The remainder of the refuse weight data from 80 companies were obtained using a scale mounted on a garbage truck (see Section 2.0) and 10 samples were "dedicated" loads from single businesses, with load weights from landfill scalehouse data. A number of firms were sampled twice during the study. The total number of samples was 212 (Table 8).

The truck collection route varied each day but, in general, the Monday route was the same each week, Tuesday routes were similar, and so forth. Occasionally, additional pick-ups were radioed to the driver, for example, businesses scheduled for "on-call" collections, sporadic customers which require pick-ups once every three to four weeks, etc. The truck-mounted scale greatly enhanced the data collection expectations initially envisaged for the study. It should be noted that the weighing procedure significantly increased the length of time that the driver had to spend at commercial customers on the collection route.

Per Employee Waste Generation

The economic slow-down has been correlated with a reduction in the amount of refuse entering the Region of Waterloo landfill sites (personal communications, R. Martiuk, Director of Solid Waste). Notable reductions in construction refuse reflect the low number of new houses being built. In theory, a reduction in commercial sales will be followed by a reduction in the retail work force. The relationship between waste generation and employment will go through a period of adjustment until the SIC sector-specific waste generation versus employment ratio is re-established. At the present level of sophistication of this study, it was not judged important to account for these potential perturbations in the work force.

4.3 Graphical Presentation of Waste Generation Versus Employment--- Potential Method to Evaluate Company Waste Management Performance?

Graphs of the study data for waste generated by businesses, versus employment (Figures 5 to 20), display the variance of "waste management performance" that has been encountered in the sample of businesses. In theory, the waste generated by businesses should be closely correlated with employment and the data should tend to fall about an imaginary linear projection line. If there are data that are greatly removed from the linear tendency of the majority of the sample points, those businesses may be targeted for investigation with respect to their waste management practices. For example, a business with exceptional

waste minimization efforts will show up as a data point that is well below the general linear grouping of businesses; a business with poor waste management policies will show up as a data point that lies well above the linear grouping of businesses.

Therefore, municipalities are advised to plot the employment/waste generation ratios in order to "get a feel" for practical problems that they can address in specific companies. A simple average of employee waste generation rates would suffice if rates, alone, were important.

While the per employee waste generation rates are simply taken as the values of `b' (slope) in Table 8, one may legitimately modify these rates, based on the number of employees in a given firm. In other words, one may divide the value for `a' (kg/day) by the number of employees in a firm and add this quotient (in units of kg/employee/day) to the value of `b'. As employment increases, the impact of the `a' (employment) on the value of `b' will decrease. No company-specific adjustments were made to waste generation estimates because we were interested only in an average estimate, representative of the SIC group as a whole, i.e., the value of `b' alone.

4.4 Usefulness of Landfill Data in Estimating Commercial Refuse Quantity

Generally, there are three systems for the collection of waste from commercial sources and delivery to landfill sites: (1) residential garbage trucks and (2) front end (or over-head) packer trucks and (3) "dedicated loads" from large supermarkets and large malls. Residential garbage trucks frequently make collections from commercial businesses as part of their daily routing through a municipality. The load is weighed at the scalehouse and the weight is normally recorded as "residential". The fraction of the waste collected from commercial businesses cannot be accurately determined under these circumstances.

Haulers using front end packer trucks frequently make between 25 and 50 refuse collections from customers before proceeding to a waste facility. A typical collection route for one of these trucks may include stops at: schools, senior citizen's homes, commercial businesses, industries, hospitals, condominiums, apartment houses, malls, etc. It is apparent that no matter what category is chosen to designate the "source" of the waste, when the load is weighed at a disposal facility, the choice will not reflect the heterogeneity of the waste in the truck. It is normal for these loads to be recorded as either "commercial" or "industrial".

Given the nature of the waste delivery systems from generator to transfer station or landfill site, most of the scalehouse data do not give a reliable picture of commercial and industrial waste generation, and to use that data in estimating waste composition would be misleading. Yet, scalehouse "records" are the basis for the widely held generalization that residential waste is "40%" of the total waste stream and commercial and industrial waste accounts for "60%". There is good reason to doubt the accuracy of this or any other percentages that rely on scalehouse weight data. The method that we have developed in the present study will enable municipalities to make a reasonable estimate of the waste generated by the commercial business sector. The method described in Volume I of the Waste Composition Study can be used to estimate the residential waste stream.

4.5 Verification of the Employee Waste Generation Estimates

In the absence of an alternative method to directly estimate the employee waste generation rates, one must defer to a comparison of the data with published literature values. Such a comparison is given in Table 10. With the exception of the generation rates for the financial operations, the results compared favourably with those of Rhyner & Green (ref. 14), especially if one were to estimate limits of ± 10 to 30% around both sets of data.

The following verification method is suggested in future studies. Using small "strip malls", estimate the total waste generation rate for each business, using the SIC per employee waste generation rate estimates (from this study) and the employment figure for each business. Compare the estimated sum of waste generated for the entire sample mall with the actual weight of waste produced by the mall.

4.6 "Light Industry"

The Standard Industrial Classification system uses the term "industry" throughout (e.g., "Retail Trade Industries"), but no categorical distinction or definition is given to the term "light", with respect to any kind of industry. Commercial businesses are also called industries, so one cannot look to the SIC code to assist in distinguishing "light" industry from "heavy" industry.

Semantic arguments and clear problems of nomenclature aside, an arbitrary decision was made to call the shoe manufacturing industry (SIC 17) and the printing industry (SIC 28) "light industry". No special methods were applied to the data gathering procedures for these businesses and therefore the data are considered tentative. This study describes sampling procedures for commercial activities that closely serve the residential sector. Longer term sampling procedures are needed to assess industrial waste stream characteristics.

SECTION 5

CONCLUSIONS & RECOMMENDATIONS

5.0 CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

1. Waste composition and per employee generation rates have been estimated for the commercial businesses in the Regional Municipality of Waterloo. The methods used in the present study provides direct estimates for 52% of the total employment in commercial business in the Region and indirect estimates for 100%. Thus, estimates of the waste generated by a segment of the commercial sector of the municipality have been made for the first time.

   The total annual tonnage received by the two Region of Waterloo landfill sites in 1989 was 439,000 tonnes. Based on the results of the present study, the commercial sector contributed an estimated 76,388 tonnes, or 17.4% of the total weight.

2. The most commonly encountered waste material in commercial refuse was corrugated cardboard (OCC) which ranged from a low of 4.0% to a high of 49.0% of the weight of refuse generated by the firms which were sampled.

   The wide range in OCC content may be the result of some firms separating used OCC for recycling, possibly in anticipation of the proposed ban on the landfilling of OCC within the Regional Municipality of Waterloo in 1991.

   Variations observed in the composition of other waste streams may be due to recycling activities, either under the auspices of company-wide programs or by conscientious employees who took materials to recycling locations in the municipality or home to their own Blue Boxes.

3. The statistical reliability of the waste composition data for some of the SIC groups is questionable because of the small number of waste samples that were sorted. Nevertheless, the data indicate the general proportion of

materials in the waste streams from the 16, two-digit SIC groups that comprise the commercial business community in the Region. Waste from 65 businesses was sorted.

4. The installation of a truck-mounted scale, used to determine the weight of refuse in 2 to 8 cubic yards refuse bins, enabled us to obtain waste quantity data from an additional 80 commercial businesses. For estimating the per employee waste generation rates, this method is more efficient than the labour intensive method, used in the waste composition part of the study, in which the crew unloaded the refuse bins by hand to determine the total weight of the waste in the bin.

5. During the course of the study, insights were noted regarding the effectiveness of waste management practices of some firms. For example, for automotive repair businesses, it appears that employee's tend to use the general refuse bin for discarding metal waste materials, despite the fact that a scrap metal bin has been made available.

   Such insights, when communicated to the management of the firm provide an immediate opportunity to help that firm improve the efficiency of their recycling efforts.

   There is also an indication that differences exist in per employee waste generation rates in small grocery stores and in larger supermarkets.

   The demonstrated method for estimating the rate of employee waste generation has the potential to be used as a waste management tool by municipalities. The distribution of the daily waste generation rates versus employment data, exhibited in the graphs for each SIC sector, could enable municipal waste management personnel to prioritize their "remedial" waste reduction efforts by planning to visit those companies whose waste generation rates seem out of line with the general waste-to-employee relationship.

5.2 Recommendations

The methods employed in the commercial portion of the Ontario Waste Composition Study have been demonstrated on a selection of commercial businesses in the Regional Municipality of Waterloo. Within the commercial sectors in the Region there is a relatively high awareness of waste diversion options that will reduce waste disposal costs and encourage recycling. Therefore, we cautiously regard the qualitative and quantitative data presented herein as a best estimate under constantly changing circumstances.

This report has developed a procedure for estimating the amount of waste generated by commercial activities within Ontario urban areas and began with the process of integrating the complex data inputs required. What are the next steps?

The study has employed a two-stage estimation process: (1) the development of ratios of waste generation per employee; and (2) the estimation of commercial employment composition for the municipality as a whole. Each step poses different problems. The following recommendations are submitted:

1. The waste generation and composition data base will require many more samples in order to cover the full range of commercial activities. No one study will have the resources to undertake a complete evaluation; the research results must be accumulated over many studies and evaluated over time. Fortunately, there is no inherent reason that a business in any part of the province cannot be used to estimate waste generated elsewhere--unless local waste management policies differ significantly.

   This means that each study should use the same SIC identification to code commercial activity and the same methodology for measuring waste output and composition. A central agency (e.g., the Ministry of Environment) may have to take the responsibility for organizing and evaluating the data.

2. It will also be necessary to monitor any changes over time in waste generation that may reflect innovations in policy, technology or corporate behaviour. The date of each sample must be retained and/or it may be necessary to identify sample locations that can be restudied over time in order to minimize sampling error.

3. To better understand the effect of recycling behaviour on the data gathered, it is recommended that employees/management of participating firms be asked to describe the nature and extent of any source separation recycling activities.

4. The immediate priorities for sampling can be identified from the results of this study. Those commercial activities that employ large numbers of people must be further investigated in order to improve sample size and reveal any significant variation within the SIC groups; this includes the diverse set of office and financial activities. Conversely, those activities with a high rate of waste generation per employee, such as food stores and restaurants, must be sampled repeatedly because of their importance to the overall waste generation. Those sectors where the observed sample variance (standard deviation) is high require larger samples to improve overall accuracy, possibly by isolating subgroups within the SIC. Activities that generate policy-relevant waste materials should be given special attention.

5. The future development of employment estimates requires two divergent approaches. First, substantial savings may result from a centralized standardized analysis of employment that applies the same set of data, techniques and projections to all urban areas--much as the Ontario Statistical Centre has developed a common set of population forecasts.

   At the same time, municipalities have better information about local peculiarities and exceptions to the employment structure. These special cases, e.g., community colleges, tourist attractions, shopping concentrations,

as well as manufacturing activities, may require special attention by a local agency.

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ACKNOWLEDGEMENTS

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The concept for the field study was developed following the advice of Dr. Virginia Maclaren that led to extensive discussions with Dr. Jim Simmons (both faculty members in the Geography Department, University of Toronto). Dr. Simmons worked with the Canada Census employment information and accessed other employment data bases in order to develop a picture of employment in the retail commercial businesses in the Regional Municipality of Waterloo. Dr. Simmons also assisted in the evaluating the field data and writing portions of the text. The project clearly benefitted from Dr. Simmons' many crucial contributions.

The field crew: David Fox (Gore & Storrie Limited), Ritchard Stevenson and Lisa Morgan (both from the Region of Waterloo) were responsible for contacting the companies, organizing an often complicated waste collection schedule and sorting the waste. They were a dedicated crew and their efforts are greatfully acknowledged.

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REFERENCES

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APPENDIX A

APPENDIX A

Results of an Empirical Analysis of Commercial Solid Waste Generation Undertaken by T.V. DeGeare and J. E. Ongerth (1971) (ref. 3)

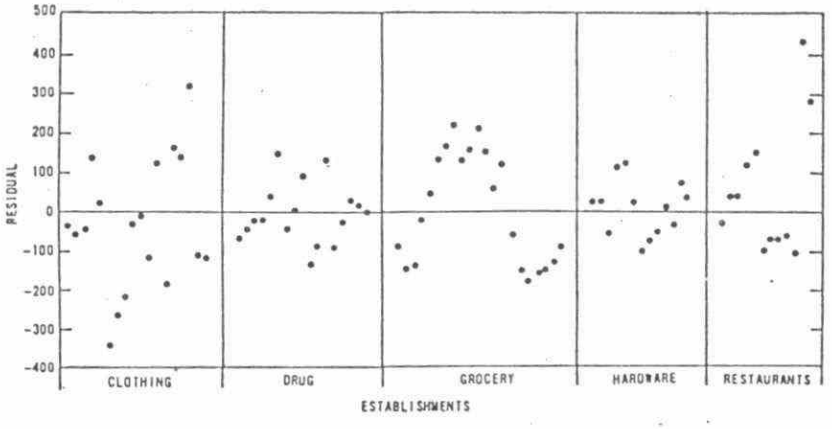

FIG. 1.—REGRESSION EQUATION RESIDUALS (See Table 1 for Data Information)

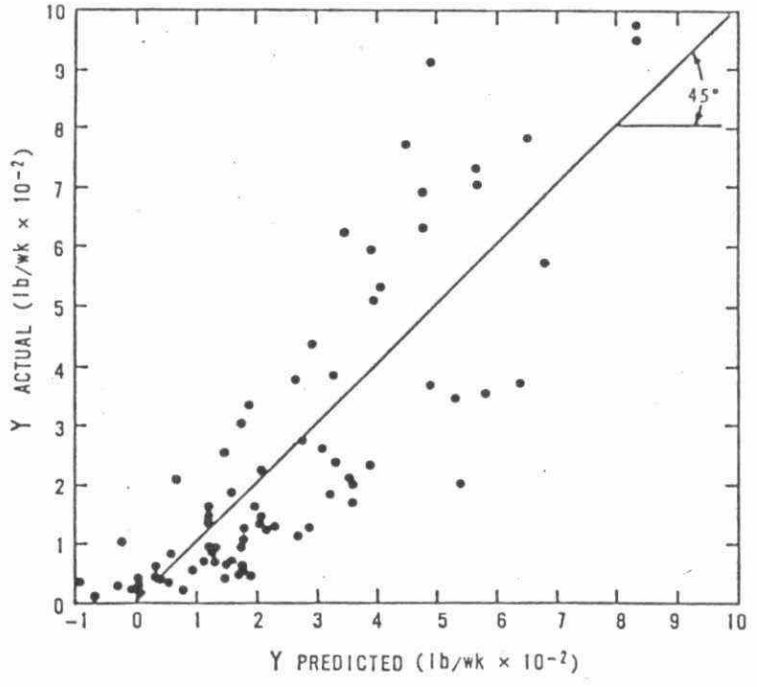

FIG. 2.—ACTUAL VERSUS PREDICTED SOLID WASTE QUANTITIES (All Stores)

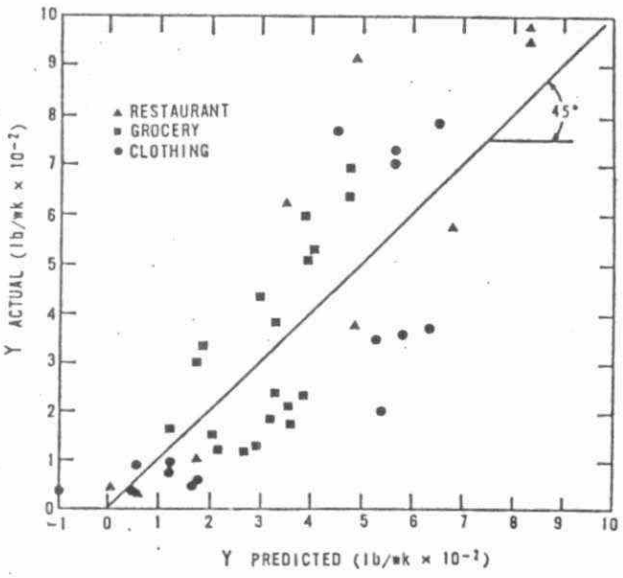

FIG. 3.—ACTUAL VERSUS PREDICTED SOLID WASTE QUANTITIES (Restaurant, Grocery, and Clothing Stores)

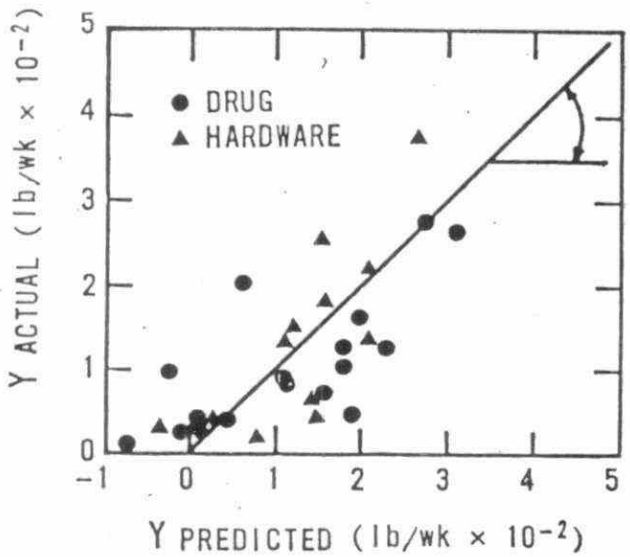

FIG. 4.—ACTUAL VERSUS PREDICTED SOLID WASTE QUANTITIES (Drug and Hardware Stores)

APPENDIX B

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC: 1712 SIC code description:
Sample # : 1 #1712 (footwear industry)
Collection Dates: July 1990

		SAMPLE #: 1 kg	% wt
(1) Paper	(a) Newsprint	0.591	2.69%
	(b) Fine Paper / CPO / Ledger	0.273	1.24%
	(c) Magazines / Flyers		
	(d) Waxed / Plastic / Mixed	0.273	1.24%
	(e) Boxboard	0.273	1.24%
	(f) Kraft	0.773	3.52%
	(g) Wallpaper		
	(h) OCC	2.636	12.01%
	(i) Tissues	0.500	2.28%
(2) Glass	(a) Beer (i) refillable		
	(ii) non-refillable	0.455	2.07%
	(b) Liquor & Wine Containers		
	(c) Food Containers	0.455	2.07%
	(d) Soft Drink (i) refillable		
	(ii) non-refillable		
	(e) Other Containers		
	(f) Plate		
	(g) Other		
(3) Ferrous	(a) Soft Drink Containers	0.032	0.15%
	(b) Food Containers		
	(c) Beer Cans (i) returnable		
	(ii) non-returnable		
	(d) Aerosol Cans		
	(e) Other		
(4) Non-Ferrous	(a) Beer Cans (i) returnable		
	(ii) non-returnable		
	(iii) American		
	(b) Soft Drink Containers	0.015	0.07%
	(c) Other Packaging		
	(d) Aluminum		
	(e) Other		
(5) Plastics	(a) Polyolefins	0.273	1.24%
	(b) PVC		
	(c) Polystyrene	0.636	2.90%
	(d) ABS		
	(e) PET		
	(f) Mixed Blend Plastic		
	(g) Coated Plastic		
	(i) Mylon		
	(i) Vinyl		
(6) Organic	(a) Food Waste / Rodent Bedding	1.000	4.55%
	(b) Yard Waste		*******
(7) Wood		3.000	13.66%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos			
(9) Diapers			
(10) Textiles/Leather/Rubber		10.591	48.23%
(11) Household Hazardous Wastes	(a) Paints / Solvents		
	(b) Waste Oils		
	(c) Pesticides/Herbicides		
(12) Dry Cell Batteries			
(13) Kitty Litter			
(14) Miscellaneous		0.184	0.84%
		*******	*******
		21.958	100.00%

TOTAL kg

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	tetrapaks	0.184
		0.184

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC:2819
Sample # : 1-3
Collection Dates:JULY-AUGUST 1990

SIC code description: #2819 (other commercial printing industry)

SAMPLE #:	1 kg	1 % wt	2 kg	2 % wt	3 kg	3 % wt	MEAN ON A WEIGHT BASIS (kg)	RANGE ON A WEIGHT BASIS MIN.	RANGE ON A WEIGHT BASIS MAX.	MEAN ON A PERCENT BASIS (%)
(1) Paper (a) Newsprint	0.136	0.23%	0.500	1.39%	0.591	0.17%	0.41	0.136	0.591	0.60%
(b) Fine Paper / CPO / Ledger	45.818	78.57%	19.636	54.59%	274.818	79.49%	113.42	19.636	274.818	70.88%
(c) Magazines / Flyers					1.318	0.38%	0.44		1.318	0.13%
(d) Waxed / Plastic / Mixed	4.682	8.03%	6.364	17.69%	4.273	1.24%	5.11	4.273	6.364	8.99%
(e) Boxboard	1.409	2.42%	1.091	3.03%	3.500	1.01%	2.00	1.091	3.500	2.15%
(f) Kraft	1.955	3.35%	3.000	8.34%	1.682	0.49%	2.21	1.682	3.000	4.06%
(g) Wallpaper										
(h) OCC			0.273	0.76%	38.909	11.25%	13.06	0.273	38.909	4.00%
(i) Tissues	0.727	1.25%	0.229	0.64%	0.227	0.07%	0.39	0.227	0.727	0.65%
(2) Glass (a) Beer (i) refillable										
(ii) non-refillable										
(b) Liquor & Wine Containers										
(c) Food Containers	0.500	0.86%					0.17	0.500	0.500	0.29%
(d) Soft Drink (i) refillable										
(ii) non-refillable	0.227	0.39%					0.08	0.227	0.227	0.13%
(e) Other Containers										
(f) Plate										
(g) Other										
(3) Ferrous (a) Soft Drink Containers	0.045	0.08%	0.030	0.08%	0.064	0.02%	0.05	0.030	0.064	0.06%
(b) Food Containers	0.318	0.55%					0.11	0.318	0.318	0.18%
(c) Beer Cans (i) returnable										
(ii) non-returnable										
(d) Aerosol Cans										
(e) Other	0.182	0.31%	0.227	0.63%	1.409	0.41%	0.61	0.182	1.409	0.45%
(4) Non-Ferrous (a) Beer Cans (i) returnable										
(ii) non-returnable										
(iii) American										
(b) Soft Drink Containers			0.047	0.13%			0.02	0.047	0.047	0.04%
(c) Other Packaging										
(d) Aluminum	0.136	0.23%	0.005	0.01%			0.05	0.005	0.136	0.08%
(e) Other										
(5) Plastics (a) Polyolefins	0.864	1.48%	0.545	1.52%	0.227	0.07%	0.55	0.227	0.864	1.02%
(b) PVC										
(c) Polystyrene	0.019	0.03%	0.075	0.21%			0.03	0.019	0.075	0.08%
(d) ABS										
(e) PET										
(f) Mixed Blend Plastic	0.020	0.03%					0.01	0.020	0.020	0.01%
(g) Coated Plastic										
(i) Nylon										
(i) Vinyl					1.364	0.39%	0.45	1.364	1.364	0.13%
(6) Organic (a) Food Waste / Rodent Bedding	0.318	0.55%	3.818	10.61%	1.182	0.34%	1.77	0.318	3.818	3.83%
(b) Yard Waste		*******		*******		*******				
(7) Wood					0.909	0.26%	0.30	0.909	0.909	0.09%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos										
(9) Diapers										
(10) Textiles/Leather/Rubber					6.318	1.83%	2.11	6.318	6.318	0.61%
(11) Household Hazardous Wastes (a) Paints / Solvents					2.955	0.85%	0.98	2.955	2.955	0.28%
(b) Waste Oils										
(c) Pesticides/Herbicides										
(12) Dry Cell Batteries										
(13) Kitty Litter										
(14) Miscellaneous	0.955	1.64%	0.131	0.36%	6.000	1.74%				
	58.31	100.00%	35.97	100.00%	345.75	100.00%	146.68	35.97	345.75	100.00%
	TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1	carbon-plastic printing plates	0.955
		0.955
2	tetrapaks	0.131
		0.131
3	small generator motor	6.000
		6.000

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

SIC code description: #4813 (combined radio\television broadcasting industry)

Municipality: Region of Waterloo
SIC: 4813
Sample # : 1
Collection Dates: June 1990

		SAMPLE #: 1 kg	1 % wt
(1) Paper	(a) Newsprint	8.682	5.57%
	(b) Fine Paper / CPO / Ledger	54.727	35.10%
	(c) Magazines / Flyers	3.909	2.51%
	(d) Waxed / Plastic / Mixed	25.591	16.41%
	(e) Boxboard	2.864	1.84%
	(f) Kraft	0.818	0.52%
	(g) Wallpaper		
	(h) OCC	9.832	6.31%
	(i) Tissues	3.682	2.36%
(2) Glass	(a) Beer (i) refillable		
	(ii) non-refillable		
	(b) Liquor & Wine Containers		
	(c) Food Containers	3.455	2.22%
	(d) Soft Drink (i) refillable		
	(ii) non-refillable	0.682	0.44%
	(e) Other Containers		
	(f) Plate		
	(g) Other		
(3) Ferrous	(a) Soft Drink Containers	0.434	0.28%
	(b) Food Containers	3.500	2.24%
	(c) Beer Cans (i) returnable		
	(ii) non-returnable		
	(d) Aerosol Cans		
	(e) Other		
(4) Non-Ferrous	(a) Beer Cans (i) returnable		
	(ii) non-returnable		
	(iii) American		
	(b) Soft Drink Containers	0.364	0.23%
	(c) Other Packaging		
	(d) Aluminum		
	(e) Other		
(5) Plastics	(a) Polyolefins	8.273	5.31%
	(b) PVC		
	(c) Polystyrene	1.545	0.99%
	(d) ABS		
	(e) PET		
	(f) Mixed Blend Plastic	1.273	0.82%
	(g) Coated Plastic	0.102	0.07%
	(i) Nylon		
	(i) Vinyl		
(6) Organic	(a) Food Waste / Rodent Bedding	22.455	14.40%
	(b) Yard Waste		*******
(7) Wood		1.091	0.70%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos			
(9) Diapers			
(10) Textiles/Leather/Rubber		0.340	0.22%
(11) Household Hazardous Wastes	(a) Paints / Solvents	1.636	1.05%
	(b) Waste Oils		
	(c) Pesticides/Herbicides		
(12) Dry Cell Batteries			
(13) Kitty Litter			
(14) Miscellaneous		0.656	0.42%
		155.910	100.00%

TOTAL kg

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	misc. plastic parts	0.056
	tetrapak	0.007
	video/audio tape	0.457
	air filter	0.136
		0.656

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC Code: 6011, 6012, 6019
Sample #: 1-5
Collection Dates: May, June, July 1990

SIC code description: #6011 (supermarket)
#6012 (grocery stores)
#6019 (specialty food stores i.e. health food)

		SIC # 6019		SIC # 6011		SIC # 6012		SIC # 6012		SIC # 6012		MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	SAMPLE #:	1		2		3		4		5					
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
(1) Paper	(a) Newsprint	0.636	2.56%			1.045	4.37%	36.636	72.05%	0.947	4.94%	7.85	0.636	36.636	16.78%
	(b) Fine Paper / CPO / Ledger	0.182	0.73%	23.636	0.41%	2.682	11.22%	0.273	0.54%	0.575	3.00%	5.47	0.182	23.636	3.18%
	(c) Magazines / Flyers											0.01			
	(d) Waxed / Plastic / Mixed	0.045	0.18%	21.818	0.38%	0.591	2.47%	0.818	1.61%	1.238	6.46%	5.32	0.045	21.818	2.22%
	(e) Boxboard	2.136	8.58%	54.818	0.95%	4.455	18.64%	3.364	6.62%	3.567	18.61%	13.80	2.136	54.818	10.68%
	(f) Kraft	2.773	11.14%	14.591	0.25%	1.273	5.33%	0.682	1.34%	0.589	3.07%	3.98	0.589	14.591	4.23%
	(g) Wallpaper														
	(h) OCC	18.682	75.04%	2098.955	36.30%	1.045	4.37%	1.818	3.58%	4.318	22.53%	424.9e	1.045	2098.955	28.37%
	(i) Tissues			186.727	3.23%	3.409	14.26%	0.545	1.07%	0.604	3.15%	38.26	0.545	186.727	4.34%
(2) Glass	(a) Beer (i) refillable														
	(ii) non-refillable							0.449	0.88%			0.09	0.449	0.449	0.18%
	(b) Liquor & Wine Containers					0.682	2.85%			1.080	5.64%	0.35	0.682	1.080	1.70%
	(c) Food Containers							0.728	1.43%			0.15	0.728	0.728	0.29%
	(d) Soft Drink (i) refillable											0.97	0.909	2.310	3.37%
	(ii) non-refillable					0.909	3.80%	2.310	4.54%	1.630	8.51%				
	(e) Other Containers														
	(f) Plate														
	(g) Other														
(3) Ferrous	(a) Soft Drink Containers					0.773	3.23%	0.909	1.79%	0.149	0.78%	0.37	0.149	0.909	1.16%
	(b) Food Containers					0.045	0.19%	0.074	0.15%	0.202	1.05%	0.06	0.045	0.202	0.28%
	(c) Beer Cans (i) returnable														
	(ii) non-returnable														
	(d) Aerosol Cans														
	(e) Other									0.005	0.03%	0.001	0.005	0.005	0.01%
(4) Non-Ferrous	(a) Beer Cans (i) returnable														
	(ii) non-returnable														
	(iii) American														
	(b) Soft Drink Containers	0.032	0.13%			0.091	0.38%	0.182	0.36%	0.155	0.81%	0.09	0.032	0.182	0.34%
	(c) Other Packaging											0.005	0.011	0.012	0.02%
	(d) Aluminum					0.011	0.05%			0.012	0.06%	0.01	0.032	0.032	0.01%
	(e) Other							0.032	0.06%						
(5) Plastics	(a) Polyolefins	0.182	0.73%	80.545	1.39%	3.545	14.83%	1.318	2.59%	1.249	6.52%	17.37	0.182	80.545	5.21%
	(b) PVC														
	(c) Polystyrene	0.045	0.18%	25.318	0.44%	0.500	2.09%	0.136	0.27%	0.089	0.46%	5.22	0.045	25.318	0.69%
	(d) ABS														
	(e) PET							0.164	0.32%			0.03	0.164	0.164	0.06%
	(f) Mixed Blend Plastic							0.045	0.09%	0.111	0.58%	0.03	0.045	0.111	0.13%
	(g) Coated Plastic					0.091	0.38%			0.071	0.37%	0.03	0.071	0.091	0.15%
	(i) Nylon														
	(l) Vinyl														
(6) Organic	(a) Food Waste / Rodent Bedding	0.182	0.73%	3064.864	53.01%	2.727	11.41%	0.364	0.72%	2.412	12.59%	614.11	0.182	3064.864	15.69%
	(b) Yard Waste		*******		********		*******		*******		*******				
(7) Wood				210.545	3.64%							42.11		210.545	0.73%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos															
(9) Diapers										0.161	0.84%	0.03	0.161	0.161	0.17%
(10) Textiles/Leather/Rubber															
(11) Household Hazardous Wastes	(a) Paints / Solvents														
	(b) Waste Oils														
	(c) Pesticides/Herbicides														
(12) Dry Cell Batteries															
(13) Kitty Litter															
(14) Miscellaneous						0.026	0.11%								
		24.90	100.00%	5781.82	100.00%	23.90	100.00%	50.85	100.00%	19.16	100.00%	1180.13	19.16	5781.82	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1		
2		
3	light bulbs	0.026
		0.026
4		
5		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

SIC code description: #6111 (shoe stores)
#6149 (other clothing stores ie.leisure wear; combination mens\womens)
#6151 (fabric and yarn stores)

Municipality: Region of Waterloo
SIC code: 6111, 6149, 6151
Sample #: 1-8
Collection Dates: June, July 1990

	SIC#	6111	SIC#	6111	SIC#	6149	SIC#	6149	SIC#	6149	SIC#	6149	SIC#	6151	SIC#	6151
SAMPLE #:	1		2		3		4		5		6		7		8	
	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper (a) Newsprint	10.455	22.92%	2.500	5.37%	0.136	0.39%	3.409	48.81%	1.409	23.88%	1.045	5.59%	1.182	6.93%	1.364	2.95%
(b) Fine Paper / CPO / Ledger	0.227	0.50%	0.545	1.17%	2.091	6.00%	0.591	8.46%	0.500	8.47%	0.818	4.38%	0.227	1.33%	0.409	0.89%
(c) Magazines / Flyers					1.227	3.52%			1.864	31.58%	0.136	0.73%			0.136	0.30%
(d) Waxed / Plastic / Mixed	0.227	0.50%	0.591	1.27%	0.909	2.61%	0.227	3.25%	0.045	0.77%	0.591	3.16%	0.091	0.53%	0.500	1.08%
(e) Boxboard	18.136	39.76%	6.227	13.38%	3.500	10.04%	0.136	1.95%	0.091	1.54%	4.545	24.31%	3.455	20.26%	5.000	10.83%
(f) Kraft	0.062	0.14%	0.091	0.20%	0.091	0.26%	0.545	7.81%	0.045	0.77%	0.045	0.24%	0.045	0.27%	1.591	3.45%
(g) Wallpaper																
(h) OCC	4.636	10.17%	31.318	67.29%	8.971	25.74%	0.455	6.51%	1.455	24.65%	6.045	32.33%	7.318	42.93%	9.063	19.63%
(i) Tissues	4.545	9.97%	1.455	3.13%	0.727	2.09%	0.136	1.95%	0.045	0.77%	0.409	2.19%	3.455	20.26%	4.773	10.34%
(2) Glass (a) Beer (i) refillable																
(ii) non-refillable							0.364	5.21%								
(b) Liquor & Wine Containers					0.880	2.52%										
(c) Food Containers	0.818	1.79%			0.236	0.68%	0.455	6.51%			0.500	2.67%			0.455	0.98%
(d) Soft Drink (i) refillable																
(ii) non-refillable									0.182	3.08%					0.227	0.49%
(e) Other Containers					0.114	0.33%										
(f) Plate																
(g) Other																
(3) Ferrous (a) Soft Drink Containers																
(b) Food Containers	0.227	0.50%			0.346	0.99%	0.136	1.95%	0.032	0.54%					0.090	0.20%
(c) Beer Cans (i) returnable											0.036	0.19%	0.063	0.37%	0.091	0.20%
(ii) non-returnable	0.032	0.07%														
(d) Aerosol Cans																
(e) Other					0.058	0.17%										
(4) Non-Ferrous (a) Beer Cans (i) returnable																
(ii) non-returnable																
(iii) American																
(b) Soft Drink Containers	0.016	0.03%			0.145	0.42%	0.030	0.43%	0.030	0.51%	0.091	0.49%	0.013	0.08%	0.030	0.06%
(c) Other Packaging																
(d) Aluminum															0.045	0.10%
(e) Other																
(5) Plastics (a) Polyolefins	1.773	3.89%	1.091	2.34%	4.909	14.08%	0.182	2.60%	0.091	1.54%	1.818	9.72%	0.545	3.20%	6.727	14.57%
(b) PVC																
(c) Polystyrene	0.136	0.30%	0.091	0.20%	0.364	1.04%	0.091	1.30%	0.045	0.77%	2.273	12.16%	0.045	0.27%	0.545	1.18%
(d) ABS																
(e) PET																
(f) Mixed Blend Plastic					0.773	2.22%										
(g) Coated Plastic																
(i) Nylon																
(i) Vinyl																
(6) Organic (a) Food Waste / Rodent Bedding	0.591	1.30%	0.091	0.20%	1.091	3.13%	0.227	3.25%	0.045	0.77%			0.545	3.20%	2.818	6.10%
(b) Yard Waste		*******		*******		*******		*******		*******		*******		*******		*******
(7) Wood			0.045	0.10%	5.727	16.43%					0.073	0.39%			0.909	1.97%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos																
(9) Diapers	0.545	1.20%														
(10) Textiles/Leather/Rubber	3.182	6.98%			2.372	6.81%			0.022	0.37%	0.004	0.02%	0.018	0.11%	0.864	1.87%
(11) Household Hazardous Wastes (a) Paints / Solvents																
(b) Waste Oils																
(c) Pesticides/Herbicides																
(12) Dry Cell Batteries																
(13) Kitty Litter																
(14) Miscellaneous			2.500	5.37%	0.186	0.53%					0.266	1.42%	0.044	0.26%	10.530	22.81%
	45.61	100.00%	46.55	100.00%	34.85	100.00%	6.98	100.00%	5.90	100.00%	18.70	100.00%	17.05	100.00%	46.17	100.00%
	TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg	

	MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
(1) Paper (a) Newsprint	2.69	0.136	10.455	14.61%
(b) Fine Paper / CPO / Ledger	0.68	0.227	2.091	3.90%
(c) Magazines / Flyers	0.42	0.136	1.864	4.52%
(d) Waxed / Plastic / Mixed	0.40	0.045	0.909	1.65%
(e) Boxboard	5.14	0.091	18.136	15.26%
(f) Kraft	0.31	0.045	1.591	1.64%
(g) Wallpaper				
(h) OCC	8.66	0.455	31.318	28.65%
(i) Tissues	1.94	0.045	4.773	6.34%
(2) Glass (a) Beer (i) refillable				
(ii) non-refillable	0.05	0.364	0.364	0.65%
(b) Liquor & Wine Containers	0.11	0.880	0.880	0.32%
(c) Food Containers	0.31	0.236	0.818	1.58%
(d) Soft Drink (i) refillable				
(ii) non-refillable	0.05	0.182	0.227	0.45%
(e) Other Containers	0.01	0.114	0.114	0.04%
(f) Plate				
(g) Other				
(3) Ferrous (a) Soft Drink Containers				
(b) Food Containers	0.08	0.032	0.346	0.46%
(c) Beer Cans (i) returnable	0.05	0.036	0.227	0.16%
(ii) non-returnable	0.004	0.032	0.032	0.01%
(d) Aerosol Cans				
(e) Other	0.01	0.058	0.058	0.02%
(4) Non-Ferrous (a) Beer Cans (i) returnable				
(ii) non-returnable				
(iii) American				
(b) Soft Drink Containers	0.04	0.013	0.145	0.25%
(c) Other Packaging				
(d) Aluminum	0.01	0.045	0.045	0.01%
(e) Other				
(5) Plastics (a) Polyolefins	2.14	0.091	6.727	6.49%
(b) PVC				
(c) Polystyrene	0.45	0.045	2.273	2.15%
(d) ABS				
(e) PET				
(f) Mixed Blend Plastic	0.10	0.077	0.773	0.28%
(g) Coated Plastic				
(i) Nylon				
(i) Vinyl				
(6) Organic (a) Food Waste / Rodent Bedding	0.68	0.045	2.818	2.24%
(b) Yard Waste				*******
(7) Wood	0.84	0.045	5.727	2.36%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos				
(9) Diapers	0.07	0.545	0.545	0.15%
(10) Textiles/Leather/Rubber	0.81	0.004	3.182	2.02%
(11) Household Hazardous Wastes (a) Paints / Solvents				
(b) Waste Oils				
(c) Pesticides/Herbicides				
(12) Dry Cell Batteries				
(13) Kitty Litter				
(14) Miscellaneous	1.69	0.044	10.530	3.80%
	27.73	5.90	46.55	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1		
2	plexiglass	2.500
		2.500
3	light bulbs	0.030
	tetrapaks	0.156
		0.186
4		
5		
6	electrical wire	0.160
	coated wire hanger	0.046
	tetrapaks	0.060
		0.266
7	tetrapaks	0.044
		0.044
8	instant start ballasts	10.000
	synthetic canvas	0.500
	tetrapaks	0.030
		10.530

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC Code: 6211, 6212, 6223, 6231, 6239
Sample #: 1-5
Collection Dates: JUNE-AUGUST 1990

#6212 (household furniture stores-without appliances\furnishings)
#6223 (appliance,television,radio and sterio repair shops)
#6231 (floor covering stores)
#6239 (other furnishing stores i.e. linen;glassware etc.)

		SIC # 6223		SIC # 6211		SIC # 6231		SIC # 6212		SIC # 6239	
SAMPLE #:		1		2		3		4		5	
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper	(a) Newsprint	0.136	2.19%	0.136	0.06%	2.791	2.44%			1.409	2.21%
	(b) Fine Paper / CPO / Ledger	1.273	20.40%	6.773	3.12%	1.909	1.67%			0.636	1.00%
	(c) Magazines / Flyers	0.455	7.28%								
	(d) Waxed / Plastic / Mixed	0.080	1.28%	2.955	1.36%	1.818	1.59%			0.136	0.21%
	(e) Boxboard	0.182	2.91%	2.227	1.02%	0.955	0.83%			3.182	4.99%
	(f) Kraft	0.032	0.51%	3.864	1.78%	2.541	2.22%			0.273	0.43%
	(g) Wallpaper										
	(h) OCC	2.242	35.93%	69.513	31.98%	24.864	21.71%	18.773	74.55%	51.352	80.55%
	(i) Tissues	0.005	0.08%	2.636	1.21%	0.093	0.08%			0.455	0.71%
(2) Glass	(a) Beer (i) refillable										
	(ii) non-refillable										
	(b) Liquor & Wine Containers										
	(c) Food Containers			0.838	0.39%	0.398	0.35%				
	(d) Soft Drink (i) refillable										
	(ii) non-refillable			0.425	0.20%	0.229	0.20%				
	(e) Other Containers										
	(f) Plate										
	(g) Other			6.364	2.93%					2.045	3.21%
(3) Ferrous	(a) Soft Drink Containers	0.060	0.96%	0.817	0.38%	0.366	0.32%			0.079	0.12%
	(b) Food Containers			0.366	0.17%						
	(c) Beer Cans (i) returnable										
	(ii) non-returnable										
	(d) Aerosol Cans			0.177	0.08%						
	(e) Other			54.636	25.14%	0.337	0.29%				
(4) Non-Ferrous	(a) Beer Cans (i) returnable										
	(ii) non-returnable									0.015	0.02%
	(iii) American										
	(b) Soft Drink Containers			0.059	0.03%	0.157	0.14%			0.078	0.12%
	(c) Other Packaging										
	(d) Aluminum			0.031	0.01%	0.009	0.01%				
	(e) Other					0.049	0.04%				
(5) Plastics	(a) Polyolefins	0.227	3.64%	10.414	4.79%	9.864	8.61%	3.818	15.16%	1.000	1.57%
	(b) PVC										
	(c) Polystyrene	0.003	0.05%	3.273	1.51%					0.364	0.57%
	(d) ABS					0.224	0.20%				
	(e) PET										
	(f) Mixed Blend Plastic										
	(g) Coated Plastic										
	(i) Nylon										
	(i) Vinyl					0.773	0.67%				
(6) Organic	(a) Food Waste / Rodent Bedding			1.909	0.88%	0.864	0.75%			0.727	1.14%
	(b) Yard Waste		*******		*******		*******		*******		*******
(7) Wood		0.091	1.46%	22.500	10.35%	0.062	0.05%	2.591	10.29%		
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos										0.091	0.14%
(9) Diapers											
(10) Textiles/Leather/Rubber				1.236	0.57%	66.203	57.80%				
(11) Household Hazardous Wastes	(a) Paints / Solvents			0.981	0.45%						
	(b) Waste Oils										
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries				0.021	0.01%						
(13) Kitty Litter											
(14) Miscellaneous		1.455	23.32%	25.208	11.60%	0.035	0.03%			1.909	2.99%
		6.24	100.00%	217.36	100.00%	114.54	100.00%	25.18	100.00%	63.75	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg	

	MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
(1) Paper	0.89	0.136	2.791	1.38%
	2.12	0.636	6.773	5.24%
	0.09	0.455	0.455	1.46%
	1.00	0.080	2.955	0.89%
	1.31	0.182	3.182	1.95%
	1.34	0.032	3.864	0.99%
	33.35	2.242	69.513	48.94%
	0.64	0.005	2.636	0.42%
(2) Glass				
	0.25	0.398	0.838	0.15%
	0.13	0.229	0.425	0.08%
	1.68	2.045	6.364	1.23%
(3) Ferrous	0.26	0.060	0.817	0.36%
	0.07	0.366	0.366	0.03%
	0.04	0.177	0.177	0.02%
	10.99	0.337	54.636	5.09%
(4) Non-Ferrous	0.003	0.015	0.015	0.005%
	0.06	0.059	0.157	0.06%
	0.01	0.009	0.031	0.004%
	0.01	0.049	0.049	0.01%
(5) Plastics	5.06	0.227	10.414	6.76%
	0.73	0.003	3.273	0.42%
	0.04	0.224	0.224	0.04%
	0.15	0.773	0.773	0.13%
(6) Organic	0.70	0.727	1.909	0.55%
(7) Wood	5.05	0.062	22.500	4.43%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos	0.02	0.091	0.091	0.03%
(9) Diapers				
(10) Textiles/Leather/Rubber	13.49	1.236	66.203	11.67%
(11) Household Hazardous Wastes	0.20	0.981	0.981	0.09%
(12) Dry Cell Batteries	0.004	0.021	0.021	0.002%
(13) Kitty Litter				
(14) Miscellaneous				
	85.41	6.24	217.36	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	electrical wire	1.455
		1.455
2	furnace air filters	4.045
	light bulbs	1.136
	floor tiles	1.864
	concrete	1.353
	compressor	16.773
	tetrapaks	0.037
		25.208
3	tetrapaks	0.035
		0.035
4		
5	plastic dishes	1.000
	acrylic dishes	0.318
	floodlights	0.591
		1.909

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC Code: 6311
Sample #: 1-6
Collection Dates: May, June, July, 1990

SIC code description: #6311 ("new" automobile dealers)

	SAMPLE #:	1		2		3		4		5		6	
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper	(a) Newsprint	2.818	20.23%	7.045	4.80%	16.318	5.81%	3.955	2.22%	4.364	3.39%	2.591	0.94%
	(b) Fine Paper / CPO / Ledger	1.000	7.18%	6.909	4.71%	6.636	2.36%	5.182	2.90%	11.273	8.76%	15.500	5.62%
	(c) Magazines / Flyers			0.099	0.07%					3.409	2.65%	1.591	0.58%
	(d) Waxed / Plastic / Mixed	0.591	4.24%	6.409	4.37%	5.773	2.06%	6.455	3.62%	0.636	0.49%	2.636	0.96%
	(e) Boxboard	0.682	4.90%	3.682	2.51%	5.455	1.94%	2.455	1.38%	4.318	3.35%	3.773	1.37%
	(f) Kraft	0.318	2.28%	8.227	5.61%	14.000	4.99%	9.000	5.04%	0.409	0.32%	7.500	2.72%
	(g) Wallpaper												
	(h) OCC			17.809	12.13%	65.727	23.41%	22.000	12.32%	6.360	4.94%	99.288	36.03%
	(i) Tissues	1.182	8.49%	5.409	3.69%	11.773	4.19%	0.636	0.36%	2.409	1.87%	6.545	2.37%
(2) Glass	(a) Beer (i) refillable			0.034	0.02%	1.802	0.64%						
	(ii) non-refillable												
	(b) Liquor & Wine Containers									0.248	0.19%		
	(c) Food Containers			2.522	1.72%	1.360	0.48%			0.393	0.31%	0.909	0.33%
	(d) Soft Drink (i) refillable												
	(ii) non-refillable	0.448	3.22%									0.227	0.08%
	(e) Other Containers					0.283	0.10%						
	(f) Plate												
	(g) Other												
(3) Ferrous	(a) Soft Drink Containers	0.096	0.69%	0.913	0.62%	0.824	0.29%	0.497	0.28%	0.237	0.18%	1.727	0.63%
	(b) Food Containers												
	(c) Beer Cans (i) returnable					2.270	0.81%						
	(ii) non-returnable												
	(d) Aerosol Cans			0.726	0.49%			0.401	0.22%			0.500	0.18%
	(e) Other			23.812	16.22%	74.565	26.55%	59.182	33.15%	54.288	42.16%	89.409	32.44%
(4) Non-Ferrous	(a) Beer Cans (i) returnable												
	(ii) non-returnable												
	(iii) American												
	(b) Soft Drink Containers	0.068	0.49%	0.132	0.09%	0.507	0.18%	0.031	0.02%	0.262	0.20%	0.545	0.20%
	(c) Other Packaging												
	(d) Aluminum			0.039	0.03%	0.060	0.02%	0.035	0.02%			0.091	0.03%
	(e) Other							0.025	0.01%				
(5) Plastics	(a) Polyolefins	1.227	8.81%	7.409	5.05%	9.591	3.42%	6.045	3.39%	3.045	2.37%	12.545	4.55%
	(b) PVC												
	(c) Polystyrene	0.364	2.61%	0.636	0.43%	2.136	0.76%	2.227	1.25%	0.318	0.25%	1.773	0.64%
	(d) ABS												
	(e) PET												
	(f) Mixed Blend Plastic	0.500	3.59%	3.001	2.04%	2.398	0.85%			0.049	0.04%		
	(g) Coated Plastic	0.021	0.15%	0.132	0.09%					0.013	0.01%		
	(i) Nylon												
	(i) Vinyl												
(6) Organic	(a) Food Waste / Rodent Bedding	0.864	6.20%	10.091	6.87%	9.864	3.51%	0.909	0.51%	0.955	0.74%	1.682	0.61%
	(b) Yard Waste		*******		*******		*******		*******		*******		*******
(7) Wood								15.591	8.73%	18.818	14.62%		
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos		0.357	2.56%										
(9) Diapers				0.129	0.09%								
(10) Textiles/Leather/Rubber		2.445	17.56%	1.962	1.34%	2.755	0.98%	3.771	2.11%	3.706	2.88%	3.682	1.34%
(11) Household Hazardous Wastes	(a) Paints / Solvents	0.619	4.45%	1.526	1.04%	8.102	2.89%	7.136	4.00%			7.955	2.89%
	(b) Waste Oils	0.261	1.87%	20.545	14.00%	23.045	8.21%	12.091	6.77%	8.545	6.64%		
	(c) Pesticides/Herbicides												
(12) Dry Cell Batteries													
(13) Kitty Litter													
(14) Miscellaneous		0.067	0.48%	17.584	11.98%	15.577	5.55%	20.886	11.70%	4.697	3.65%	15.136	5.49%
		*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
		13.93	100.00%	146.78	100.00%	280.82	100.00%	178.51	100.00%	128.75	100.00%	275.61	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg	

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	silicon sealant (aluminum tube	0.067
		0.067
2	head light	0.591
	body filler	1.682
	foam packing	0.528
	spark plugs	0.260
	respirator	0.147
	gaskets	0.307
	clutch cables	0.727
	filters	1.887
	oil cooler	2.591
	mixed auto plastic	2.500
	side stripping	1.409
	shocks	4.955
		17.584
3	auto plastic	5.000
	air filters	5.818
	audio speakers	1.364
	headlights, misc. lightbulbs	3.395
		15.577
4	mixed auto plastic	5.136
	clutch plates	1.182
	gaskets	1.455
	fibreglass autoparts	0.249
	filters	4.136
	van hood(heavy plastic)	8.727
		20.886
5	auto plastic	3.818
	air filter	0.364
	headlights, misc. lightbulbs	0.515
		4.697
6	air filters	13.955
	auto plastic	1.045
	wind shield wiper blades	0.136
		15.136

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC: 6331
Sample # : 1-3
Collection Dates: May 1990

SIC code description: #6331 (gasoline service station i.e.gas bar)

		SAMPLE #: 1 kg	1 % wt	2 kg	2 % wt	3 kg	3 % wt	MEAN ON A WEIGHT BASIS (kg)	RANGE ON A WEIGHT BASIS Min.	RANGE ON A WEIGHT BASIS Max.	Mean ON A PERCENT BASIS (%)
(1) Paper	(a) Newsprint	0.051	0.61%	0.818	6.06%	4.136	31.60%	1.67	0.051	4.136	12.76%
	(b) Fine Paper / CPO / Ledger	0.227	2.70%	1.455	10.78%	0.273	2.08%	0.65	0.227	1.455	5.19%
	(c) Magazines / Flyers			0.034	0.25%			0.01	0.034	0.034	0.08%
	(d) Waxed / Plastic / Mixed	0.227	2.70%	0.591	4.38%	0.545	4.17%	0.45	0.227	0.591	3.75%
	(e) Boxboard	0.136	1.62%	0.773	5.73%	0.045	0.35%	0.32	0.045	0.773	2.57%
	(f) Kraft	0.136	1.62%	0.143	1.06%	0.045	0.35%	0.11	0.045	0.143	1.01%
	(g) Wallpaper										
	(h) OCC	2.636	31.36%	1.364	10.11%	0.182	1.39%	1.39	0.182	2.636	14.28%
	(i) Tissues	0.682	8.11%	1.136	8.42%	0.364	2.78%	0.73	0.364	1.136	6.44%
(2) Glass	(a) Beer (i) refillable										
	(ii) non-refillable										
	(b) Liquor & Wine Containers										
	(c) Food Containers	0.424	5.04%			0.318	2.43%	0.25	0.318	0.424	2.49%
	(d) Soft Drink (i) refillable										
	(ii) non-refillable			0.843	6.25%	0.864	6.60%	0.57	0.843	0.864	4.28%
	(e) Other Containers										
	(f) Plate										
	(g) Other										
(3) Ferrous	(a) Soft Drink Containers	0.087	1.03%	0.030	0.22%	0.045	0.35%	0.05	0.030	0.087	0.53%
	(b) Food Containers			0.056	0.41%			0.02	0.056	0.056	0.14%
	(c) Beer Cans (i) returnable										
	(ii) non-returnable										
	(d) Aerosol Cans										
	(e) Other			0.198	1.47%			0.07	0.198	0.198	0.49%
(4) Non-Ferrous	(a) Beer Cans (i) returnable			0.018	0.13%			0.01	0.018	0.018	0.04%
	(ii) non-returnable										
	(iii) American										
	(b) Soft Drink Containers	0.187	2.22%	0.065	0.48%	0.364	2.78%	0.21	0.065	0.364	1.83%
	(c) Other Packaging										
	(d) Aluminum			0.032	0.24%			0.01	0.032	0.032	0.06%
	(e) Other										
(5) Plastics	(a) Polyolefins	0.864	10.27%	3.273	24.25%	5.318	40.63%	3.15	0.864	5.318	25.05%
	(b) PVC										
	(c) Polystyrene	0.057	0.68%	0.128	0.95%	0.091	0.69%	0.09	0.057	0.128	0.77%
	(d) ABS										
	(e) PET										
	(f) Mixed Blend Plastic	0.500	5.95%	0.021	0.16%			0.17	0.021	0.500	2.03%
	(g) Coated Plastic										
	(i) Nylon										
	(j) Vinyl										
(6) Organic	(a) Food Waste / Rodent Bedding	0.409	4.87%	1.591	11.79%	0.500	3.82%	0.83	0.409	1.591	6.82%
	(b) Yard Waste		*******		*******		*******				
(7) Wood											
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos											
(9) Diapers		0.081	0.96%					0.03	0.081	0.081	0.32%
(10) Textiles/Leather/Rubber		0.952	11.32%	0.042	0.31%			0.33	0.042	0.952	3.88%
(11) Household Hazardous Wastes	(a) Paints / Solvents	0.726	8.64%	0.875	6.48%			0.53	0.726	0.875	5.04%
	(b) Waste Oils										
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries											
(13) Kitty Litter											
(14) Miscellaneous		0.024	0.29%	0.009	0.07%						
		8.41	100.00%	13.49	100.00%	13.09	100.00%	11.66	8.41	13.49	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1	tetrapaks	0.024
		0.024
2	twist ties, zipper	0.009
		0.009
3		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC Code: 6351, 6352, 6353, 6342
Sample #: 1-5
Collection Dates: May, June, July 1990

SIC code description: #6351 (general repair garages)
#6352 (paint\body repair shops)
#6353 (muffler replacement shop)
#6342 (tire;battery;parts\ accessories stores)

		SIC # 6351		SIC # 6352		SIC # 6342		SIC # 6342		SIC # 6353	
SAMPLE #:		1		2		3		4		5	
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper	(a) Newsprint	3.364	7.90%			4.864	6.02%	1.682	2.70%		
	(b) Fine Paper / CPO / Ledger	0.909	2.13%	1.682	2.38%	3.273	4.05%	1.273	2.04%		
	(c) Magazines / Flyers							1.909	3.06%		
	(d) Waxed / Plastic / Mixed	0.545	1.28%	2.455	3.47%	3.955	4.90%	0.500	0.80%	0.067	0.89%
	(e) Boxboard	1.909	4.48%	2.136	3.02%	2.273	2.82%	3.818	6.12%	0.167	2.21%
	(f) Kraft	0.091	0.21%	18.409	26.06%	0.773	0.96%	0.364	0.58%		
	(g) Wallpaper										
	(h) OCC	3.909	9.18%	0.136	0.19%	16.564	20.52%	4.409	7.07%		
	(i) Tissues	0.137	0.32%	2.636	3.73%	0.136	0.17%	0.500	0.80%	0.016	0.21%
(2) Glass	(a) Beer (i) refillable							0.455	0.73%		
	(ii) non-refillable										
	(b) Liquor & Wine Containers										
	(c) Food Containers	0.170	0.40%	1.318	1.87%			1.545	2.48%		
	(d) Soft Drink (i) refillable										
	(ii) non-refillable	0.462	1.08%	0.818	1.16%			0.500	0.80%		
	(e) Other Containers					0.339	0.42%				
	(f) Plate										
	(g) Other										
(3) Ferrous	(a) Soft Drink Containers	0.331	0.78%	0.818	1.16%	0.393	0.49%	0.136	0.22%	0.047	0.62%
	(b) Food Containers	0.163	0.38%	0.088	0.12%			0.045	0.07%		
	(c) Beer Cans (i) returnable										
	(ii) non-returnable										
	(d) Aerosol Cans					0.561	0.69%	0.136	0.22%		
	(e) Other			11.409	16.15%	0.020	0.02%	26.636	42.70%	0.052	0.69%
(4) Non-Ferrous	(a) Beer Cans (i) returnable							0.227	0.36%	0.017	0.22%
	(ii) non-returnable										
	(iii) American					0.015	0.02%				
	(b) Soft Drink Containers			0.273	0.39%	0.109	0.14%	0.015	0.02%	0.033	0.44%
	(c) Other Packaging										
	(d) Aluminum			0.029	0.04%						
	(e) Other										
(5) Plastics	(a) Polyolefins	1.409	3.31%	3.955	5.60%	2.591	3.21%	1.091	1.75%	1.182	15.63%
	(b) PVC										
	(c) Polystyrene	0.136	0.32%	0.182	0.26%	0.591	0.73%	0.227	0.36%	0.182	2.40%
	(d) ABS										
	(e) PET										
	(f) Mixed Blend Plastic			2.500	3.54%	0.590	0.73%	1.591	2.55%		
	(g) Coated Plastic			0.068	0.10%						
	(i) Nylon										
	(i) Vinyl										
(6) Organic	(a) Food Waste / Rodent Bedding	0.545	1.28%	1.955	2.77%	1.682	2.08%				
	(b) Yard Waste		*******		*******		*******		*******		*******
(7) Wood										2.300	30.41%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos											
(9) Diapers										1.818	24.04%
(10) Textiles/Leather/Rubber		2.045	4.80%	5.958	8.43%	16.645	20.62%	11.591	18.58%	0.773	10.22%
(11) Household Hazardous Wastes	(a) Paints / Solvents	1.097	2.58%	3.545	5.02%						
	(b) Waste Oils	7.500	17.61%	0.909	1.29%	3.039	3.76%				
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries											
(13) Kitty Litter											
(14) Miscellaneous		17.865	41.95%	9.364	13.26%	22.319	27.65%	3.727	5.97%	0.909	12.02%
		42.59	100.00%	70.64	100.00%	80.73	100.00%	62.38	100.00%	7.56	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg	

	MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
(1) Paper (a) Newsprint	1.98	1.682	4.864	3.32%
(b) Fine Paper / CPO / Ledger	1.43	0.909	3.273	2.12%
(c) Magazines / Flyers	0.38	1.910	1.909	0.61%
(d) Waxed / Plastic / Mixed	1.50	0.067	3.955	2.27%
(e) Boxboard	2.06	0.167	3.818	3.73%
(f) Kraft	3.93	0.091	18.409	5.56%
(g) Wallpaper				
(h) OCC	5.00	0.163	16.564	7.39%
(i) Tissues	0.69	0.016	2.636	1.05%
(2) Glass (a) Beer (i) refillable	0.09	0.450	0.455	0.15%
(ii) non-refillable				
(b) Liquor & Wine Containers				
(c) Food Containers	0.61	0.170	1.545	0.95%
(d) Soft Drink (i) refillable				
(ii) non-refillable	0.36	0.462	0.818	0.61%
(e) Other Containers	0.07	0.340	0.339	0.08%
(f) Plate				
(g) Other				
(3) Ferrous (a) Soft Drink Containers	0.35	0.047	0.818	0.65%
(b) Food Containers	0.06	0.045	0.163	0.12%
(c) Beer Cans (i) returnable				
(ii) non-returnable				
(d) Aerosol Cans	0.14	0.136	0.561	0.18%
(e) Other	7.62	0.020	26.636	11.91%
(4) Non-Ferrous (a) Beer Cans (i) returnable	0.05	0.017	0.227	0.12%
(ii) non-returnable				
(iii) American	0.003	0.015	0.015	0.004%
(b) Soft Drink Containers	0.09	0.015	0.273	0.20%
(c) Other Packaging				
(d) Aluminum	0.01	0.029	0.029	0.01%
(e) Other				
(5) Plastics (a) Polyolefins	2.05	1.091	3.955	5.90%
(b) PVC				
(c) Polystyrene	0.26	0.136	0.591	0.82%
(d) ABS				
(e) PET				
(f) Mixed Blend Plastic	0.94	0.590	2.500	1.36%
(g) Coated Plastic	0.01	0.068	0.068	0.02%
(i) Nylon				
(i) Vinyl				
(6) Organic (a) Food Waste / Rodent Bedding	0.84	0.545	1.955	1.23%
(b) Yard Waste				
(7) Wood	0.46	2.300	2.300	6.08%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos				
(9) Diapers	0.36	1.820	1.818	4.81%
(10) Textiles/Leather/Rubber	7.40	0.773	16.645	12.53%
(11) Household Hazardous Wastes (a) Paints / Solvents	0.93	1.097	3.545	1.52%
(b) Waste Oils	2.29	0.909	7.500	4.53%
(c) Pesticides/Herbicides				
(12) Dry Cell Batteries				
(13) Kitty Litter				
(14) Miscellaneous				
	52.78	7.56	80.73	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	air, oil, fuel filters	2.409
	light bulbs	1.139
	misc parts(spark plugs,wire..)	3.418
	brake pads	5.591
	auto lights	2.036
	speaker	0.455
	shocks	2.818
		17.865
2	oil filters	9.364
		9.364
3	air filters	1.213
	lights	0.888
	air flow sensor	0.427
	fuse	0.010
	oil filters	0.025
	shocks	1.801
	misc(brake cables, pads, etc.)	17.955
		22.319
4	air filters	3.727
		3.727
5	antifreeze	0.909
		0.909

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC Code: 6521, 6542, 6562, 6591
Sample #: 1-6
Collection Dates: May, June, July, 1990

SIC code description:
#6521 (florist shops)
#6542 (bicycle shops)
#6562 (watch\jewellery repair shops)
#6591 (second-hand merchandise stores)

		SIC # 6591		SIC # 6521		SIC # 6542		SIC # 6521		SIC # 6562		SIC # 6521	
SAMPLE #:		1		2		3		4		5		6	
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper	(a) Newsprint	0.045	1.89%	1.455	4.31%	0.030	0.09%	0.227	1.38%	0.909	24.24%	3.136	13.89%
	(b) Fine Paper / CPO / Ledger	0.409	17.04%	0.318	0.94%	0.500	1.48%	0.227	1.38%	0.455	12.12%	0.364	1.61%
	(c) Magazines / Flyers	0.147	6.12%										
	(d) Waxed / Plastic / Mixed	0.136	5.68%	0.636	1.88%	0.409	1.21%	0.091	0.55%	0.136	3.64%	0.227	1.01%
	(e) Boxboard	0.318	13.26%	1.000	2.96%	1.182	3.49%	0.409	2.48%	0.227	6.06%	0.364	1.61%
	(f) Kraft	0.019	0.80%	0.227	0.67%	0.227	0.67%	0.136	0.83%	0.091	2.42%	0.727	3.22%
	(g) Wallpaper												
	(h) OCC	0.008	0.34%	2.173	6.44%	18.136	53.59%	4.818	29.16%	1.318	35.14%	4.500	19.93%
	(i) Tissues	0.038	1.59%	0.591	1.75%	0.409	1.21%	0.227	1.38%	0.273	7.27%	0.500	2.21%
(2) Glass	(a) Beer (i) refillable												
	(ii) non-refillable												
	(b) Liquor & Wine Containers												
	(c) Food Containers	0.136	5.68%					1.364	8.25%			0.162	0.72%
	(d) Soft Drink (i) refillable												
	(ii) non-refillable												
	(e) Other Containers												
	(f) Plate												
	(g) Other												
(3) Ferrous	(a) Soft Drink Containers	0.273	11.36%	0.182	0.54%	0.054	0.16%	0.091	0.55%			0.059	0.26%
	(b) Food Containers												
	(c) Beer Cans (i) returnable												
	(ii) non-returnable												
	(d) Aerosol Cans							0.136	0.83%			0.045	0.20%
	(e) Other			0.012	0.03%	1.318	3.90%						
(4) Non-Ferrous	(a) Beer Cans (i) returnable												
	(ii) non-returnable												
	(iii) American												
	(b) Soft Drink Containers	0.030	1.25%	0.033	0.10%	0.013	0.04%	0.182	1.10%	0.036	0.96%	0.047	0.21%
	(c) Other Packaging												
	(d) Aluminum			0.010	0.03%							0.030	0.13%
	(e) Other												
(5) Plastics	(a) Polyolefins	0.318	13.26%	1.136	3.37%	0.864	2.55%	0.955	5.78%	0.136	3.64%	0.909	4.03%
	(b) PVC												
	(c) Polystyrene	0.182	7.57%	1.409	4.17%	0.136	0.40%	0.136	0.83%	0.033	0.88%	0.045	0.20%
	(d) ABS												
	(e) PET												
	(f) Mixed Blend Plastic							0.273	1.65%			0.020	0.09%
	(g) Coated Plastic												
	(i) Nylon												
	(i) Vinyl												
(6) Organic	(a) Food Waste / Rodent Bedding	0.318	13.26%	24.182	71.61%	2.318	6.85%	4.727	28.61%	0.136	3.64%	11.409	50.53%
	(b) Yard Waste		*******		*******		*******		*******		*******		*******
(7) Wood				0.102	0.30%	0.136	0.40%	0.136	0.83%				
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos				0.237	0.70%								
(9) Diapers													
(10) Textiles/Leather/Rubber		0.022	0.91%			7.980	23.58%	1.500	9.08%			0.036	0.16%
(11) Household Hazardous Wastes	(a) Paints / Solvents												
	(b) Waste Oils												
	(c) Pesticides/Herbicides												
(12) Dry Cell Batteries													
(13) Kitty Litter													
(14) Miscellaneous				0.065	0.19%	0.128	0.38%	0.888	5.37%				
		2.40	100.00%	33.77	100.00%	33.84	100.00%	16.52	100.00%	3 75	100.00%	22.58	100.00%
		TOTAL kg		TOTAL kg		TOTAL		TOTAL kg		TOTAL kg		TOTAL kg	

	MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS *		MEAN ON A PERCENT BASIS
	MEAN (kg)	RANGE (kg) MIN.	MAX.	MEAN (%)
(1) Paper	0.97	0.030	3.136	7.63%
	0.38	0.227	0.500	5.76%
	0.02	0.147	0.147	1.02%
	0.27	0.091	0.636	2.33%
	0.58	0.227	1.182	4.98%
	0.24	0.019	0.727	1.43%
	5.16	0.008	18.136	24.10%
	0.34	0.038	0.591	2.57%
(2) Glass				
	0.28	0.162	1.364	2.44%
(3) Ferrous	0.11	0.054	0.273	2.15%
	0.03	0.045	0.136	0.17%
	0.22	0.012	1.318	0.66%
(4) Non-Ferrous	0.06	0.013	0.182	0.61%
	0.01	0.010	0.030	0.03%
(5) Plastics	0.72	0.136	1.136	5.44%
	0.32	0.033	1.409	2.34%
	0.05	0.020	0.273	0.29%
(6) Organic	7.18	0.136	24.182	29.08%
(7) Wood	0.06	0.102	0.136	0.25%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos	0.04	0.237	0.237	0.12%
(9) Diapers				
(10) Textiles/Leather/Rubber	1.59	0.022	7.980	5.62%
(11) Household Hazardous Wastes				
(12) Dry Cell Batteries				
(13) Kitty Litter				
(14) Miscellaneous				
	18.81	2.40	33.84	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1		
2	tetra pak	0.039
	cigarett lighter (plastic)	0.016
	cotton (wet)	0.010
		0.065
3	bicycle foam	0.182
		0.182
4	tetrapaks	0.024
	oasis (wet)	0.864
		0.888
5		
6		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

SIC code description: #7021 (chartered banks)
#7031 (trust companies)
#7051 (local credit union)

Municipality: Region of Waterloo
SIC Code: 7021, 7031, 7051
Sample #: 1-5
Collection Dates: June 1990

		SIC # 7021		SIC # 7021		SIC # 7031		SIC # 7021		SIC # 7051		MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	SAMPLE #:	1		2		3		4		5					
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	MEAN (kg)	RANGE(kg) MIN.	MAx.	MEAN (%)
(1) Paper	(a) Newsprint	2.045	8.75%	0.510	1.89%	0.455	10.22%					0.60	0.455	2.045	4.17%
	(b) Fine Paper / CPO / Ledger	16.103	68.87%	18.091	66.96%			9.091	62.70%	2.136	66.42%	9.08	2.136	18.091	52.99%
	(c) Magazines / Flyers			0.255	0.94%							0.05	0.255	0.255	0.19%
	(d) Waxed / Plastic / Mixed	0.018	0.08%	1.500	5.55%			3.455	23.83%			0.99	0.018	3.455	5.89%
	(e) Boxboard	0.182	0.78%	0.364	1.35%	0.136	3.06%	0.318	2.19%			0.20	0.136	0.364	1.48%
	(f) Kraft	0.031	0.13%	0.691	2.56%	0.018	0.40%	0.364	2.51%	0.004	0.12%	0.22	0.004	0.691	1.15%
	(g) Wallpaper														
	(h) OCC	0.955	4.08%			0.591	13.28%	0.636	4.39%			0.44	0.591	0.955	4.35%
	(i) Tissues	0.591	2.53%	0.419	1.55%	0.273	6.13%	0.035	0.24%	0.033	1.03%	0.27	0.033	0.591	2.29%
(2) Glass	(a) Beer (i) refillable														
	(ii) non-refillable														
	(b) Liquor & Wine Containers														
	(c) Food Containers									0.861	26.77%	0.17	0.861	0.861	5.35%
	(d) Soft Drink (i) refillable														
	(ii) non-refillable			0.708	2.62%							0.14	0.708	0.708	0.52%
	(e) Other Containers														
	(f) Plate														
	(g) Other														
(3) Ferrous	(a) Soft Drink Containers			0.486	1.80%	0.124	2.79%	0.031	0.21%			0.13	0.031	0.486	0.96%
	(b) Food Containers			0.298	1.10%							0.06	0.298	0.298	0.22%
	(c) Beer Cans (i) returnable														
	(ii) non-returnable														
	(d) Aerosol Cans														
	(e) Other			0.138	0.51%					0.025	0.78%	0.03	0.025	0.138	0.26%
(4) Non-Ferrous	(a) Beer Cans (i) returnable														
	(ii) non-returnable														
	(iii) American														
	(b) Soft Drink Containers			0.059	0.22%					0.014	0.44%	0.01	0.014	0.059	0.13%
	(c) Other Packaging														
	(d) Aluminum														
	(e) Other									0.025	0.78%	0.01		0.025	0.16%
(5) Plastics	(a) Polyolefins	0.682	2.92%	1.009	3.73%	0.455	10.22%	0.455	3.14%	0.036	1.12%	0.53	0.036	1.009	4.22%
	(b) PVC														
	(c) Polystyrene	0.080	0.34%	0.275	1.02%	0.080	1.80%			0.022	0.68%	0.09	0.022	0.275	0.77%
	(d) ABS														
	(e) PET														
	(f) Mixed Blend Plastic			0.955	3.53%			0.091	0.63%			0.21	0.091	0.955	0.83%
	(g) Coated Plastic														
	(i) Nylon														
	(i) Vinyl														
(6) Organic	(a) Food Waste / Rodent Bedding	2.182	9.33%	0.789	2.92%	2.318	52.10%			0.060	1.87%	1.07	0.060	2.318	13.24%
	(b) Yard Waste		*******		********		*******		*******		********				
(7) Wood															
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos		0.206	0.88%									0.04	0.206	0.206	0.18%
(9) Diapers															
(10) Textiles/Leather/Rubber		0.293	1.25%	0.214	0.79%			0.023	0.16%			0.11	0.023	0.293	0.44%
(11) Household Hazardous Wastes	(a) Paints / Solvents														
	(b) Waste Oils														
	(c) Pesticides/Herbicides														
(12) Dry Cell Batteries															
(13) Kitty Litter															
(14) Miscellaneous		0.014	0.06%	0.259	0.96%										
		23.38	100.00%	27.02	100.00%	4.45	100.00%	14.50	100.00%	3.22	100.00%	14.51	3.22	27.02	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	tetrapaks	0.014
		0.014
2	tetrapaks	0.113
	power cord	0.146
		0.259
3		
4		
5		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

SIC code description: #9111 (hotels\motor hotels)
#9112 (motels)

Municipality: Region of Waterloo
SIC Code: 9111, 9112
Sample #: 1-6
Collection Dates: May, June, July, 1990

		SIC # 9111		SIC # 9111		SIC # 9111		SIC # 9112		SIC # 9112		SIC # 9111		
SAMPLE #:		1		2		3		4		5		6		
		kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	kg	% wt	
(1) Paper	(a) Newsprint	46.500	18.58%	62.091	11.49%	21.455	20.31%	7.909	16.31%	3.455	3.93%	6.955	15.99%	
	(b) Fine Paper / CPO / Ledger	6.818	2.72%	17.045	3.15%	4.909	4.65%	0.818	1.69%	1.318	1.50%	1.182	2.72%	
	(c) Magazines / Flyers			4.500	0.83%	1.520	1.44%					0.364	0.84%	
	(d) Waxed / Plastic / Mixed	3.909	1.56%	40.727	7.54%	4.955	4.69%	2.000	4.12%	4.364	4.97%	1.273	2.93%	
	(e) Boxboard	7.000	2.80%	17.909	3.31%	7.318	6.93%	6.000	12.37%	3.773	4.30%	1.727	3.97%	
	(f) Kraft	1.636	0.65%	3.091	0.57%	2.364	2.24%	0.818	1.69%	2.682	3.05%	4.091	9.41%	
	(g) Wallpaper													
	(h) OCC	86.591	34.59%	80.596	14.91%	3.680	3.48%	0.455	0.94%	2.940	3.35%	1.872	4.30%	
	(i) Tissues	6.727	2.69%	23.500	4.35%	8.959	8.48%	1.909	3.94%	5.091	5.80%	2.136	4.91%	
(2) Glass	(a) Beer (i) refillable	0.227	0.09%	1.032	0.19%	0.760	0.72%			0.819	0.93%	1.591	3.66%	
	(ii) non-refillable	0.455	0.18%									1.591	3.66%	
	(b) Liquor & Wine Containers	3.693	1.48%	35.000	6.48%	5.227	4.95%	1.136	2.34%	7.545	8.59%	1.227	2.82%	
	(c) Food Containers	5.545	2.22%	13.091	2.42%	4.825	4.57%	1.114	2.30%	0.573	0.65%	1.727	3.97%	
	(d) Soft Drink (i) refillable							0.727	1.50%	2.000	2.28%			
	(ii) non-refillable	3.219	1.29%	9.157	1.69%			1.591	3.28%	2.227	2.54%	1.773	4.08%	
	(e) Other Containers													
	(f) Plate													
	(g) Other	2.273	0.91%	5.614	1.04%	0.233	0.22%	0.514	1.06%	0.173	0.20%	0.318	0.73%	
(3) Ferrous	(a) Soft Drink Containers	0.636	0.25%	2.034	0.38%	3.761	3.56%			3.864	4.40%	1.000	2.30%	
	(b) Food Containers	1.045	0.42%	2.300	0.43%	0.555	0.53%	0.333	0.69%	0.196	0.22%	0.091	0.21%	
	(c) Beer Cans (i) returnable			0.016	0.003%									
	(ii) non-returnable			0.158	0.03%			1.318	2.72%					
	(d) Aerosol Cans					0.178	0.17%	0.273	0.56%			0.136	0.31%	
	(e) Other			2.088	0.39%	0.527	0.50%	0.076	0.16%	0.079	0.09%	0.136	0.31%	
(4) Non-Ferrous	(a) Beer Cans (i) returnable	0.227	0.09%	1.995	0.37%			0.500	1.03%	0.081	0.09%	0.682	1.57%	
	(ii) non-returnable					0.072	0.07%							
	(iii) American	0.091	0.04%	0.136	0.03%	0.088	0.08%							
	(b) Soft Drink Containers	0.606	0.24%	1.595	0.30%	0.050	0.05%	0.500	1.03%	2.513	2.86%	1.091	2.51%	
	(c) Other Packaging			0.091	0.02%					0.032	0.04%	0.034	0.08%	
	(d) Aluminum	0.045	0.02%	0.756	0.14%	0.128	0.12%	0.203	0.42%	0.261	0.30%	0.045	0.10%	
	(e) Other			3.142	0.58%					0.141	0.16%			
(5) Plastics	(a) Polyolefins	14.818	5.92%	26.227	4.85%	6.318	5.98%	2.954	6.09%	6.398	7.29%	4.045	9.30%	
	(b) PVC													
	(c) Polystyrene	1.500	0.60%	4.000	0.74%	3.364	3.18%	1.000	2.06%	3.864	4.40%	0.636	1.46%	
	(d) ABS													
	(e) PET	0.059	0.02%	4.741	0.88%	0.155	0.15%	0.062	0.13%	0.318	0.36%	0.136	0.31%	
	(f) Mixed Blend Plastic	0.737	0.29%	3.271	0.61%	0.581	0.55%			0.157	0.18%	0.045	0.10%	
	(g) Coated Plastic	0.051	0.02%					0.136	0.28%	0.098	0.11%			
	(i) Nylon													
	(i) Vinyl													
(6) Organic	(a) Food Waste / Rodent Bedding	47.318	18.90%	126.795	23.46%	19.273	18.25%	10.864	22.41%	16.136	18.38%	5.455	12.54%	
	(b) Yard Waste		*******		*******		*******		*******		*******		*******	
(7) Wood		1.136	0.45%	3.000	0.56%	0.050	0.05%	0.006	0.01%	5.546	6.32%	0.045	0.10%	
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos		1.005	0.40%					0.156	0.32%	0.251	0.29%			
(9) Diapers		1.455	0.58%	5.818	1.08%			2.273	4.69%	0.591	0.67%	0.182	0.42%	
(10) Textiles/Leather/Rubber		4.727	1.89%	37.105	6.87%	4.195	3.97%	1.091	2.25%	1.043	1.19%			
(11) Household Hazardous Wastes	(a) Paints / Solvents													
	(b) Waste Oils													
	(c) Pesticides/Herbicides													
(12) Dry Cell Batteries		0.255	0.10%			0.086	0.08%			0.260	0.30%			
(13) Kitty Litter								1.591	3.28%	7.727	8.80%			
(14) Miscellaneous		0.012	0.00%	1.827	0.34%	0.030	0.03%	0.160	0.33%	1.278	1.46%	1.909	4.39%	
		*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	
		250.32	100.00%	540.45	100.00%	105.61	100.00%	48.49	100.00%	87.79	100.00%	43.50	100.00%	
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg		

MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
24.73	3.455	62.091	14.44%
5.35	0.818	17.045	2.74%
1.06	0.364	4.500	0.52%
9.54	1.273	40.727	4.30%
7.29	1.727	17.909	5.61%
2.45	0.818	4.091	2.94%
29.36	0.455	86.591	10.26%
8.05	1.909	23.500	5.03%
0.74	0.227	1.591	0.93%
0.34	0.455	1.591	0.64%
8.97	1.136	35.000	4.44%
4.48	0.573	13.091	2.69%
0.45	0.727	2.000	0.63%
2.99	1.591	9.157	2.15%
1.52	0.173	5.614	0.69%
1.88	0.636	3.864	1.82%
0.75	0.091	2.300	0.41%
0.003	0.016	0.016	0.0005%
0.25	0.158	1.318	0.46%
0.10	0.136	0.273	0.17%
0.48	0.076	2.088	0.24%
0.58	0.081	1.995	0.53%
0.01	0.072	0.072	0.01%
0.05	0.088	0.136	0.02%
1.06	0.050	2.513	1.16%
0.03	0.032	0.091	0.02%
0.24	0.045	0.756	0.18%
0.55	0.141	3.142	0.12%
10.13	2.954	26.227	6.57%
2.39	0.636	4.000	2.08%
0.91	0.059	4.741	0.31%
0.80	0.045	3.271	0.29%
0.05	0.051	0.136	0.07%
37.64	5.455	126.795	18.99%
1.63	0.006	5.546	1.25%
0.24	0.156	1.005	0.17%
1.72	0.182	5.818	1.24%
8.03	1.043	37.105	2.69%
0.10	0.086	0.260	0.08%
1.55	1.591	7.727	2.01%
179.36	43.50	540.45	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE #	ITEM	WEIGHT (kg)
1	tetrapaks	0.012
		0.012
2	flourescent light bulb	0.091
	light bulbs	0.058
	tetrapaks	0.269
	dum poles	1.409
		1.827
3	light bulbs	0.030
		0.030
4	tetrapaks	0.130
	light bulb	0.030
		0.160
5	flourescent bulbs	0.682
	light bulbs	0.088
	tetrapaks	0.047
	propane tank	0.461
		1.278
6	air filter	1.909
		1.909

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC:9211
Sample # : 1-3
Collection Dates:JUNE-AUGUST 1990

SIC code description: #9211 (licensed restaurant)

		SAMPLE #: 1 kg	1 % wt	2 kg	2 % wt	3 kg	3 % wt	MEAN ON A WEIGHT BASIS MEAN (kg)	RANGE ON A WEIGHT BASIS RANGE(kg) MIN.	MAX.	MEAN ON A PERCENT BASIS MEAN (%)
(1) Paper	(a) Newsprint	14.773	3.14%			0.517	0.35%	5.10	0.517	14.773	1.16%
	(b) Fine Paper / CPO / Ledger	4.659	0.99%	2.227	0.62%	2.318	1.59%	3.07	2.227	4.659	1.07%
	(c) Magazines / Flyers										
	(d) Waxed / Plastic / Mixed			3.409	0.95%	0.909	0.62%	1.44	0.909	3.409	0.52%
	(e) Boxboard	0.277	0.06%	2.636	0.73%	1.682	1.15%	1.53	0.277	2.636	0.65%
	(f) Kraft	0.955	0.20%	2.091	0.58%	0.409	0.28%	1.15	0.409	2.091	0.36%
	(g) Wallpaper										
	(h) OCC	7.920	1.68%	34.204	9.53%	22.356	15.29%	21.49	7.920	34.204	8.84%
	(i) Tissues			14.136	3.94%	5.818	3.98%	6.65	5.818	14.136	2.64%
(2) Glass	(a) Beer (i) refillable	2.591	0.55%					0.86	2.591	2.591	0.18%
	(ii) non-refillable			2.545	0.71%	8.500	5.81%	3.68	2.545	8.500	2.17%
	(b) Liquor & Wine Containers			11.227	3.13%	31.955	21.85%	14.39	11.227	31.955	8.33%
	(c) Food Containers	131.727	27.99%	2.000	0.56%	1.455	0.99%	45.06	1.455	131.727	9.85%
	(d) Soft Drink (i) refillable										
	(ii) non-refillable										
	(e) Other Containers										
	(f) Plate										
	(g) Other	6.909	1.47%	0.364	0.10%	1.818	1.24%	3.03	0.364	6.909	0.94%
(3) Ferrous	(a) Soft Drink Containers										
	(b) Food Containers	12.568	2.67%	2.318	0.65%			4.96	2.318	12.568	1.11%
	(c) Beer Cans (i) returnable										
	(ii) non-returnable										
	(d) Aerosol Cans										
	(e) Other			0.409	0.11%			0.14	0.409	0.409	0.04%
(4) Non-Ferrous	(a) Beer Cans (i) returnable			0.060	0.02%			0.02	0.060	0.060	0.01%
	(ii) non-returnable										
	(iii) American										
	(b) Soft Drink Containers	0.148	0.03%					0.05	0.148	0.148	0.01%
	(c) Other Packaging			0.136	0.04%	0.070	0.05%	0.07	0.070	0.136	0.03%
	(d) Aluminum			2.057	0.57%	0.192	0.13%	0.75	0.192	2.057	0.23%
	(e) Other	0.010	0.00%			0.112	0.08%	0.04	0.010	0.112	0.03%
(5) Plastics	(a) Polyolefins	37.250	7.91%	25.591	7.13%	2.955	2.02%	21.93	2.955	37.250	5.69%
	(b) PVC										
	(c) Polystyrene	0.032	0.01%	2.045	0.57%	1.500	1.03%	1.19	0.032	2.045	0.53%
	(d) ABS										
	(e) PET										
	(f) Mixed Blend Plastic			0.157	0.04%	0.108	0.07%	0.09	0.108	0.157	0.04%
	(g) Coated Plastic			0.110	0.03%			0.04	0.110	0.110	0.01%
	(i) Nylon										
	(i) Vinyl										
(6) Organic	(a) Food Waste / Rodent Bedding	245.136	52.08%	248.545	69.29%	62.727	42.90%	185.47	62.727	248.545	54.76%
	(b) Yard Waste		*******		*******		*******				
(7) Wood		5.727	1.22%	2.364	0.66%			2.70	2.364	5.727	0.63%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos						0.822	0.56%	0.27	0.822	0.822	0.19%
(9) Diapers											
(10) Textiles/Leather/Rubber				0.089	0.02%			0.03	0.089	0.089	0.01%
(11) Household Hazardous Wastes	(a) Paints / Solvents										
	(b) Waste Oils										
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries											
(13) Kitty Litter											
(14) Miscellaneous											
		470.68	100.00%	358.72	100.00%	146.22	100.00%	325.21	146.22	470.68	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1		
2		
3		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC:9213
Sample # : 1-3
Collection Dates:JULY-AUGUST

SIC code description: #9213 (take-out food services i.e. hamburger restaurant)

	SAMPLE #:	1 kg	1 % wt	2 kg	2 % wt	3 kg	3 % wt	MEAN ON A WEIGHT BASIS (kg)	RANGE ON A WEIGHT BASIS MIN.	RANGE ON A WEIGHT BASIS MAX.	MEAN ON A PERCENT BASIS (%)
(1) Paper	(a) Newsprint			0.045	0.05%	1.182	1.26%	0.41	0.045	1.182	0.44%
	(b) Fine Paper / CPO / Ledger			0.636	0.65%	0.727	0.77%	0.45	0.636	0.727	0.48%
	(c) Magazines / Flyers										
	(d) Waxed / Plastic / Mixed	5.727	11.63%	3.955	4.07%	5.818	6.20%	5.17	3.955	5.818	7.30%
	(e) Boxboard	1.955	3.97%	9.318	9.58%	4.000	4.26%	5.09	1.955	9.318	5.94%
	(f) Kraft	0.591	1.20%	3.091	3.18%	9.000	9.59%	4.23	0.591	9.000	4.66%
	(g) Wallpaper										
	(h) OCC	2.636	5.35%	62.045	63.79%	13.856	14.76%	26.18	2.636	62.045	27.97%
	(i) Tissues	3.091	6.28%	3.591	3.69%	3.682	3.92%	3.45	3.091	3.682	4.63%
(2) Glass	(a) Beer (i) refillable										
	(ii) non-refillable										
	(b) Liquor & Wine Containers										
	(c) Food Containers	0.227	0.46%			19.955	21.26%	6.73	0.227	19.955	7.24%
	(d) Soft Drink (i) refillable	0.682	1.38%					0.23	0.682	0.682	0.46%
	(ii) non-refillable										
	(e) Other Containers										
	(f) Plate										
	(g) Other										
(3) Ferrous	(a) Soft Drink Containers	0.090	0.18%					0.03	0.090	0.090	0.06%
	(b) Food Containers	0.318	0.65%			9.636	10.27%	3.32	0.318	9.636	3.64%
	(c) Beer Cans (i) returnable	0.020	0.04%					0.01	0.020	0.020	0.01%
	(ii) non-returnable										
	(d) Aerosol Cans										
	(e) Other					0.727	0.77%	0.24	0.727	0.727	0.26%
(4) Non-Ferrous	(a) Beer Cans (i) returnable										
	(ii) non-returnable										
	(iii) American										
	(b) Soft Drink Containers										
	(c) Other Packaging										
	(d) Aluminum										
	(e) Other										
(5) Plastics	(a) Polyolefins	4.636	9.41%	1.773	1.82%	5.091	5.42%	3.83	1.773	5.091	5.55%
	(b) PVC										
	(c) Polystyrene	1.318	2.68%	1.773	1.82%	1.000	1.07%	1.36	1.000	1.773	1.85%
	(d) ABS										
	(e) PET										
	(f) Mixed Blend Plastic			0.273	0.28%			0.09	0.270	0.273	0.09%
	(g) Coated Plastic	0.090	0.18%					0.03	0.090	0.090	0.06%
	(i) Nylon										
	(i) Vinyl										
(6) Organic	(a) Food Waste / Rodent Bedding	26.227	53.26%	10.773	11.07%	19.182	20.44%	18.73	10.773	26.227	28.26%
	(b) Yard Waste		*******		*******		*******				
(7) Wood											
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos											
(9) Diapers											
(10) Textiles/Leather/Rubber		0.045	0.09%					0.02	0.045	0.045	0.03%
(11) Household Hazardous Wastes	(a) Paints / Solvents										
	(b) Waste Oils										
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries											
(13) Kitty Litter											
(14) Miscellaneous		1.590	3.23%								
		49.24	100.00%	97.27	100.00%	93.86	100.00%	80.12	49.24	97.27	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1	fluorescent tubes	1.591
		1.591
2		
3		

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC: 9213 GENERAL
Sample # : 1-3
Collection Dates: JUNE-JULY 1990

SIC code description: #9213 (general take-out food services i.e. Chinese food)

	SAMPLE #:	1 kg	1 % wt	2 kg	2 % wt	3 kg	3 % wt	MEAN ON A WEIGHT BASIS (kg)	RANGE ON A WEIGHT BASIS (kg) MIN.	RANGE ON A WEIGHT BASIS (kg) MAX.	MEAN ON A PERCENT BASIS (%)
(1) Paper	(a) Newsprint	6.273	18.52%			2.455	1.16%	2.91	2.455	6.273	6.56%
	(b) Fine Paper / CPO / Ledger	0.045	0.13%			0.591	0.28%	0.21	0.045	0.591	0.14%
	(c) Magazines / Flyers										
	(d) Waxed / Plastic / Mixed	1.773	5.23%	0.060	0.35%	3.636	1.72%	1.82	0.060	3.636	2.43%
	(e) Boxboard	4.136	12.21%	0.091	0.53%	6.227	2.95%	3.48	0.091	6.227	5.23%
	(f) Kraft	2.409	7.11%	0.132	0.77%	2.545	1.20%	1.70	0.132	2.545	3.03%
	(g) Wallpaper										
	(h) OCC	1.875	5.53%	1.773	10.32%	25.876	12.24%	9.84	1.773	25.876	9.36%
	(i) Tissues	1.273	3.76%	0.409	2.38%	12.227	5.78%	4.64	0.409	12.227	3.97%
(2) Glass	(a) Beer (i) refillable					0.500	0.24%	0.17	0.500	0.500	0.08%
	(ii) non-refillable										
	(b) Liquor & Wine Containers					0.545	0.26%	0.18	0.545	0.545	0.09%
	(c) Food Containers	0.409	1.21%			2.682	1.27%	1.03	0.409	2.682	0.83%
	(d) Soft Drink (i) refillable										
	(ii) non-refillable					1.091	0.52%	0.36	1.091	1.091	0.17%
	(e) Other Containers										
	(f) Plate										
	(g) Other					0.591	0.28%	0.20	0.591	0.591	0.09%
(3) Ferrous	(a) Soft Drink Containers			0.191	1.11%	0.136	0.06%	0.11	0.136	0.191	0.39%
	(b) Food Containers	0.091	0.27%	1.364	7.94%			0.48	0.091	1.364	2.74%
	(c) Beer Cans (i) returnable										
	(ii) non-returnable										
	(d) Aerosol Cans										
	(e) Other										
(4) Non-Ferrous	(a) Beer Cans (i) returnable										
	(ii) non-returnable										
	(iii) American										
	(b) Soft Drink Containers					0.136	0.06%	0.05	0.136	0.136	0.02%
	(c) Other Packaging										
	(d) Aluminum					0.116	0.05%	0.04	0.116	0.116	0.02%
	(e) Other										
(5) Plastics	(a) Polyolefins	1.682	4.96%	0.773	4.50%	7.136	3.38%	3.20	0.773	7.136	4.28%
	(b) PVC										
	(c) Polystyrene	1.091	3.22%	0.025	0.15%	9.045	4.28%	3.39	0.025	9.045	2.55%
	(d) ABS										
	(e) PET										
	(f) Mixed Blend Plastic					2.273	1.08%	0.76	2.273	2.273	0.36%
	(g) Coated Plastic										
	(i) Nylon										
	(i) Vinyl										
(6) Organic	(a) Food Waste / Rodent Bedding	12.818	37.84%	12.364	71.96%	133.000	62.91%	52.73	12.364	133.000	57.57%
	(b) Yard Waste		*******		*******		*******				
(7) Wood											
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos											
(9) Diapers											
(10) Textiles/Leather/Rubber											
(11) Household Hazardous Wastes	(a) Paints / Solvents										
	(b) Waste Oils										
	(c) Pesticides/Herbicides										
(12) Dry Cell Batteries											
(13) Kitty Litter											
(14) Miscellaneous						0.591	0.28%				
		33.87	100.00%	17.18	100.00%	211.40	100.00%	87.49	17.18	211.40	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg					

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1		
2		
3	light bulbs	0.591
		0.591

Ministry of the Environment
Waste Composition Study

GORE & STORRIE LIMITED

Municipality: Region of Waterloo
SIC: 9621, 9691, 9692, 9699
Sample # : 1-4
Collection Dates: June, July 1990

SIC code description:
#9621 (regular motion picture theatres)
#9691 (bowling alleys\billiard parlours)
#9692 (amusement park;carnival)
#9699 (other amusement\recreation -al services i.e. horseback riding operations)

		SIC # 9699		SIC # 9621		SIC # 9691		SIC # 9692	
	SAMPLE #:	1		2		3		4	
		kg	% wt	kg	% wt	kg	% wt	kg	% wt
(1) Paper	(a) Newsprint	1.636	3.09%	1.545	0.81%	0.727	0.82%	0.455	0.17%
	(b) Fine Paper / CPO / Ledger	1.591	3.00%	1.455	0.76%	2.364	2.68%	3.636	1.37%
	(c) Magazines / Flyers			9.500	4.98%				
	(d) Waxed / Plastic / Mixed	1.500	2.83%	30.182	15.81%	1.182	1.34%	10.591	3.98%
	(e) Boxboard	1.273	2.40%	33.000	17.29%	6.455	7.32%	11.045	4.15%
	(f) Kraft	1.455	2.74%	1.136	0.60%			2.545	0.96%
	(g) Wallpaper								
	(h) OCC	0.939	1.77%	14.789	7.75%	12.809	14.53%	33.178	12.47%
	(i) Tissues	4.773	9.01%	25.500	13.36%	0.773	0.88%	6.045	2.27%
(2) Glass	(a) Beer (i) refillable							0.273	0.10%
	(ii) non-refillable								
	(b) Liquor & Wine Containers			0.532	0.28%	1.636	1.86%	11.682	4.39%
	(c) Food Containers	0.273	0.51%	2.989	1.57%			6.955	2.61%
	(d) Soft Drink (i) refillable								
	(ii) non-refillable			2.008	1.05%	0.182	0.21%	1.227	0.46%
	(e) Other Containers	0.091	0.17%						
	(f) Plate								
	(g) Other					0.045	0.05%	2.000	0.75%
(3) Ferrous	(a) Soft Drink Containers	1.182	2.23%	0.557	0.29%	0.030	0.03%	0.864	0.32%
	(b) Food Containers	0.136	0.26%			0.273	0.31%	5.727	2.15%
	(c) Beer Cans (i) returnable								
	(ii) non-returnable								
	(d) Aerosol Cans			0.330	0.17%				
	(e) Other			6.409	3.36%	0.182	0.21%	4.273	1.61%
(4) Non-Ferrous	(a) Beer Cans (i) returnable	0.015	0.03%	0.016	0.01%			0.136	0.05%
	(ii) non-returnable			0.042	0.02%				
	(iii) American								
	(b) Soft Drink Containers	0.455	0.86%	0.532	0.28%			0.727	0.27%
	(c) Other Packaging								
	(d) Aluminum					0.045	0.05%	0.182	0.07%
	(e) Other								
(5) Plastics	(a) Polyolefins	2.318	4.37%	15.909	8.34%	1.591	1.80%	10.227	3.84%
	(b) PVC								
	(c) Polystyrene	0.364	0.69%	4.500	2.36%	3.091	3.51%	6.455	2.43%
	(d) ABS								
	(e) PET	0.318	0.60%						
	(f) Mixed Blend Plastic					0.136	0.15%		
	(g) Coated Plastic								
	(i) Nylon								
	(i) Vinyl								
(6) Organic	(a) Food Waste / Rodent Bedding	6.136	11.58%	39.364	20.62%	7.773	8.82%	79.318	29.81%
	(b) Yard Waste		*******		*******		*******		*******
(7) Wood		24.182	45.63%			10.045	11.39%	0.591	0.22%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos								0.591	0.22%
(9) Diapers				0.318	0.17%			5.045	1.90%
(10) Textiles/Leather/Rubber		3.995	7.54%	0.227	0.12%	1.409	1.60%	0.955	0.36%
(11) Household Hazardous Wastes	(a) Paints / Solvents								
	(b) Waste Oils								
	(c) Pesticides/Herbicides								
(12) Dry Cell Batteries								0.318	0.12%
(13) Kitty Litter									
(14) Miscellaneous		0.364	0.69%	0.025	0.01%	37.421	42.44%	61.000	22.93%
		*******	*******	*******	*******	*******	*******	*******	*******
		52.99	100.00%	190.87	100.00%	88.17	100.00%	266.04	100.00%
		TOTAL kg		TOTAL kg		TOTAL kg		TOTAL kg	

	MEAN ON A WEIGHT BASIS	RANGE ON A WEIGHT BASIS		MEAN ON A PERCENT BASIS
	MEAN (kg)	RANGE(kg) MIN.	MAX.	MEAN (%)
(1) Paper (a) Newsprint	1.09	0.455	1.636	1.22%
(b) Fine Paper / CPO / Ledger	2.26	1.455	3.636	1.95%
(c) Magazines / Flyers	2.37	9.500	9.500	1.24%
(d) Waxed / Plastic / Mixed	10.86	1.182	30.182	5.99%
(e) Boxboard	12.94	1.273	33.000	7.79%
(f) Kraft	1.28	1.136	2.545	1.07%
(g) Wallpaper				
(h) OCC	15.43	0.939	33.178	9.13%
(i) Tissues	9.27	0.773	25.500	6.38%
(2) Glass (a) Beer (i) refillable	0.07	0.273	0.273	0.03%
(ii) non-refillable				
(b) Liquor & Wine Containers	3.46	0.532	11.682	1.63%
(c) Food Containers	2.55	0.273	6.955	1.17%
(d) Soft Drink (i) refillable				
(ii) non-refillable	0.85	0.182	2.008	0.43%
(e) Other Containers	0.02	0.091	0.091	0.04%
(f) Plate				
(g) Other	0.51	0.045	2.000	0.20%
(3) Ferrous (a) Soft Drink Containers	0.66	0.030	1.182	0.72%
(b) Food Containers	1.53	0.136	5.727	0.68%
(c) Beer Cans (i) returnable				
(ii) non-returnable				
(d) Aerosol Cans	0.08	0.330	0.330	0.04%
(e) Other	2.72	0.182	6.409	1.29%
(4) Non-Ferrous (a) Beer Cans (i) returnable	0.04	0.015	0.136	0.02%
(ii) non-returnable	0.01	0.042	0.042	0.01%
(iii) American				
(b) Soft Drink Containers	0.43	0.455	0.727	0.35%
(c) Other Packaging				
(d) Aluminum	0.06	0.045	0.182	0.03%
(e) Other				
(5) Plastics (a) Polyolefins	7.51	1.591	15.909	4.59%
(b) PVC				
(c) Polystyrene	3.60	0.364	6.455	2.24%
(d) ABS				
(e) PET	0.08	0.318	0.318	0.15%
(f) Mixed Blend Plastic	0.03	0.136	0.136	0.04%
(g) Coated Plastic				
(i) Nylon				
(i) Vinyl				
(6) Organic (a) Food Waste / Rodent Bedding	33.15	6.136	79.318	17.71%
(b) Yard Waste				
(7) Wood	8.70	0.519	24.182	14.31%
(8) Ceramics / Rubble / Fiberglass / Gypsum Board / Asbestos	0.15	0.591	0.591	0.06%
(9) Diapers	1.34	0.318	5.045	0.52%
(10) Textiles/Leather/Rubber	1.65	0.227	3.995	2.40%
(11) Household Hazardous Wastes (a) Paints / Solvents				
(b) Waste Oils				
(c) Pesticides/Herbicides				
(12) Dry Cell Batteries	0.08	0.318	0.318	0.03%
(13) Kitty Litter				
(14) Miscellaneous				
	149.52	52.99	266.04	100.00%

MISCELLANEOUS ITEMS

NOTE: *** = NO WEIGHT RECORDED

SAMPLE	ITEM	WEIGHT (kg)
1	tetrapaks	0.364
		0.364
2	tetrapak	0.025
		0.025
3	press board	3.091
	tree cuttings	25.455
	paint shavings	7.364
	drywall	1.273
	fluorescent tubes	0.227
	tetrapaks	0.012
		37.421
4	golf balls	5.864
	light bulbs	0.091
	fluorescent tubes	1.909
	tetrapaks	0.364
	tree limbs	52.773
		61.000